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SAMUEL A. KING.

THE BALLOON.

NOTEWORTHY AERIAL VOYAGES,

FROM THE

DISCOVERY OF THE BALLOON

TO THE PRESENT TIME.

WITH A

Narrative of the Aeronautic Experiences of Mr. Samuel A. King,

AND

A Full Description of his Great Captive Balloons and their Apparatus.

WITH ILLUSTRATIONS.

New York:

THE AMERICAN AERONAUTIC SOCIETY OF NEW YORK (LIMITED.)
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THE STEAM CAPTIVE BALLOONS OF PROF. KING.

All previous balloon enterprises undertaken in this country are dwarfed in comparison with the plan which has resulted in the Aeronautic Observatory of Prof. S. A. King. The balloons themselves are much greater than any ever before used for captive ascensions in America, and are the fruit of the most skillful calculation, of numerous inventions and of patient and long continued experiments. The subsequent pages contain a detailed description of this great aeronautic apparatus.

THE AERONAUTIC SOCIETY.

The origin of the enterprise is due to the discoveries made by Prof. King, during a series of experiments that occupied him almost constantly for more than two years, and in which he had the aid of an experience as a practical aeronaut of nearly thirty years. These discoveries enabled him to so improve the construction of the balloon that he had no difficulty in demonstrating the feasibility of building an air ship that would retain its buoyant principle for weeks if desired. Prof. King, moreover, having satisfied himself from long-continued observations, that a great proportion of the easterly gales on our coast move clear across the ocean, announced his willingness to undertake the trans-Atlantic air voyage in a ship of his own construction. His plans having been carefully considered, an association was formed to enable him to enter upon their execution.

During the winter of 1878-9 the whole field of aeronautics was carefully explored with a view of ascertaining the most feasible method of proceeding. It was decided as a preliminary to enter upon a series of observations of the weather conditions at different altitudes at or near the sea shore, and during the portion of the year deemed most suitable for entering upon the long voyage. At the same time it was believed desirable to arouse general interest in the matter by publicly exhibiting the required apparatus.

The Manhattan Beach Improvement Company very kindly offered an advantageous site on their property contiguous to the ocean. Their offer was accepted, and the plans for construction were placed in the

hands of expert engineers. Several months were spent in settling upon the various details, but early in the year preparations were actively entered upon.

THE PROJECT ANNOUNCED.

The following letter to the New York *Herald*, and published in that journal April 7, 1879, is of interest in this connection :

PHILADELPHIA, April 5, 1879.

To the Editor of the Herald :

I trust that you will allow me through your widely circulated columns space in which to make a statement to the public of my plans and purposes during the coming season. For a period of nearly thirty years I have made a study and practice of aerial navigation. During the whole of this time, in the course of which I have made somewhat over two hundred ascensions, without injury to life or limb, I have steadily endeavored to avail myself of whatever experience or suggestion might afford to make traveling in the air practical, definite and useful. Numerous and often costly experiments have shown me that, with no mechanical appliance or power yet discovered is it possible to journey definitely and with certitude through the air to any previously designated point, in opposition to the direction of a prevailing wind. The balloon, therefore remains to-day what it was in the days of the Montgolfiers, a machine that all the skill and ingenuity of man cannot prevent from floating with the wind, which controls and directs it absolutely from the moment it is launched. The application of any known mechanical power, to be of any use as against a wind directed upon the vast surface of a balloon, is entirely impracticable in consequence of the weight involved. We must, it is evident, await the results of the discoveries of an Edison, or until some one else shall have succeeded in devising a harness with which to control the electric current.

But it seems to me that a great deal can be accomplished with the balloon, slave of the wind though it be. Thus far balloon voyages have been limited to the duration of a few hours at most. The longest voyage on record in this country was that made by Messrs. Gager, LaMountain, Hyde and Wise, from St. Louis, Mo., to Henderson, New York, in 1859. The balloon left St. Louis at six o'clock on the evening of July 1, and at thirty-five minutes past two o'clock on the following afternoon it made its landing. I have myself made an air voyage of over five hundred miles ; but, generally speaking, balloon journeys have been very brief, extending over comparatively limited stretch of country. The reasons for this are as plain and true as when thus expressed by the English aeronaut, Green, in 1840 :

Apart from the leakage of the balloon itself (which, however, when in perfect condition, is not excessively material) a variety of circumstances attend its progress through the air by which, in ordinary cases, its power of sustaining itself becomes gradually impaired and ultimately, of course, completely overcome. Of these one of the most formidable is the difficulty of making the balloon retain the same elevation in the atmosphere and of avoiding those fluctuations in the level of its course by which it becomes subjected to the alternate exhaustion of gas by expansion and consequent loss of ballast in order to furnish an equivalent diminution of weight. The extent to which this condition of the art, exercised in the usual form is capable of operating will be more readily appreciated when we observe that, at an elevation of 3,000 feet, the density of the atmosphere is nearly one-tenth less than at the immediate surface of the earth. The gas, therefore, expanding as it ascends, at that altitude occupies one-tenth more space than under its original pressure. A balloon, consequently, fully inflated at its quitting the ground, must,

ere it attain that elevation, part with such a proportion of its contents ; and this, too, without taking into account any unfavorable change in the temperature by which it might, and probably would, be accompanied. To a balloon like that of Vauxhall Gardens, containing about 80,000 cubic feet, this loss would amount to about 8,000 feet. Now, the average sustaining power of carburetted hydrogen, or coal gas, is about 36 pounds weight for every 1,000 cubic feet; consequently, the loss of power experienced in this slight ascent would be equal to 288 pounds—much more than would be lost by leakage from a good balloon kept inflated at the earth's surface in a week. Again, at the approach of night, upon the passage through clouds charged with vapor, or under the influence of a shower of rain, a large quantity of moisture becomes absorbed by the balloon netting and other apparatus, frequently to the extent of 200 or 300 weight, requiring an immediate discharge of ballast to that amount to prevent her being borne to the ground. As the morning approaches, or the influence of increasing heat begins to be felt, this moisture becomes dissipated, and there being no means of collecting or recovering the discharged ballast, the balloon, lightened of her temporary encumbrance, rapidly rises in the air, her contents of gas expanding on her course and rendering its liberation necessary to prevent the consequences we have before described. These alterations continuing to operate more or less frequently—at least once in every twenty-four hours—it need scarcely be observed, must very soon put an end to her power, however originally great, and forcibly terminate her progress through the air.

These reasons are plain, as I have stated, because of the manner in which aeronauts have managed and operated their balloons. Is it possible to operate them so as to prolong their carrying ability? This is a question which has long vexed those versed in air voyaging, and it is one which I am prepared, after a series of very careful experiments, to answer in the affirmative, and I may speak confidently of my ability to make a balloon voyage of a month's duration, sufficient, with a thirty-five mile breeze, to circumnavigate the globe. The experiments in which I have been engaged almost exclusively for the last two years have demonstrated to my satisfaction that it is not only feasible to construct a balloon that will maintain the bulk of its lifting power, but that it is also easily practicable to keep it afloat and in transit for this length of time.

The results of my experiments have been laid before a number of gentlemen of ample means in your city, and they have taken sufficient interest in the subject to place at my disposal the funds necessary to enable me to continue my experiments until I shall have attained a result that will abundantly justify me in undertaking a trans-Atlantic voyage in a balloon. I have secured an eligible and convenient location at Manhattan Beach, where I shall establish an aeronautic observatory during the coming season. I shall construct here a wooden enclosure, 35 feet high and 200 feet in diameter, for the purpose of affording my balloons and apparatus proper protection from the winds. I shall have two spheroidal balloons, each of a diameter of 65 feet, and of a capacity of about 150,000 cubic feet of gas. I shall, of course, work but one balloon at a time, but shall provide the extra balloon in case of damage to the other. I shall construct my own gas works and inflate with hydrogen, which is far superior to common gas and has nearly double the lifting power. Thus equipped I shall be able to conduct captive ascensions from the sea coast during the summer season, and make observations on the state of the atmosphere and the prevailing direction of the winds from various altitudes. I shall use a cable 1,000 feet in length to elevate and lower the balloon, and this cable will be worked by a steam hoisting apparatus. It is my purpose to make these ascensions during both day and night, except when the weather prevents, and I shall be able to record a great variety of observations and experiences which will be of incalculable use to me in the future. Thus equipped with experience derived from actual experiments during a large number of as-

censions made under every possible condition, I propose to fit out a balloon in which it is my intention to make the trans-Atlantic attempt in earnest. This effort may not be made until the Spring or Fall of 1880, as it will require several months in which to construct the proper apparatus, which will entail an air ship of double the size of those I shall use in my captive experiments. My observatory at Manhattan Beach I expect to have in thorough working order by the 15th of June next.

Permit me to say, in conclusion, that I am a thorough believer in the system by which the *Herald* weather predictions are made, and that I expect to be able to demonstrate by my ocean voyage their accuracy, Professor Loomis to the contrary notwithstanding.

SAMUEL A. KING, Aeronaut.

Concerning this letter the *Herald* editorially commented as follows:

The communication from the well known aeronaut, Professor King, which we print elsewhere, will revive interest in the question of transatlantic ballooning, which from time to time in the past has agitated all classes of people here. The hitherto insuperable difficulty of sustaining a balloon at a great altitude against the loss of lifting power by leakage, the increase of weight by absorption of atmospheric moisture, by contraction at low temperatures, gradual loss of ballast, and so forth, Mr. King claims to have overcome. Having thus, as he believes, secured his ability to keep up he proposes to attempt in due season to cross the Atlantic in the air. Certainly Mr. King has solved a very important factor in the problem if he can keep his balloon afloat for a month at a time. It is significant, of the hand-in-hand march of science that this experienced aeronaut deduces from the continued successes of the *Herald* in predicting the arrival of storms on the European coasts the certainty of traversing the Atlantic on the same aerial path as those atmospheric disturbances. What directs the storm will direct the balloon, since, as the Professor aptly says, the balloon is "the slave of the wind." A discovery like that, now so fully tested, of forecasting the path of storms continually opens up still greater possibilities, and the establishment of aerial communication with Europe, fantastic as the thought has appeared to the thoughtless, is one that may well possess a fascination for the pioneers of science. Meantime we are glad to learn that Mr. King has been placed in a position to conduct the necessary preliminary experiments. We shall watch the growth of his project with lively interest.

GENERAL DESCRIPTION.

The Captive balloons *Pioneer* and *Atlantic* are constructed of the best Irish linen, and are rendered so absolutely impermeable as to hold their gas day after day without sustaining any appreciable loss. They contain each 144,000 cubic feet of gas, and each aerostat forms an immense sphere, the diameter of which is 65 feet. They have an ascensive force of 10,080 pounds, and the total weight of each balloon including netting, ropes and car, is 3,452 pounds. Each is furnished with a large valve at its crown and at the lower part, or neck. The upper one can be opened by the aeronaut while seated in the car; the lower one opens automatically to permit the escape of the gas when the balloon is too much expanded.



The globe is enveloped in a net of cords resting on a reserve net made of webbing. Terminating at its lower part, in a series of crows' feet, the network is attached by the intermediation of ropes to a metallic circle, capable of resisting in every direction a strain of 50,000 pounds.

The wicker car, of oval form, is 36 feet in circumference. At one side of the car is a vertical groove extending in to the width of the seats, and in this groove fits the cable, a strong rope $1\frac{1}{2}$ inches in diameter, which is connected at its upper end to the balloon by the intermediation of a metal dynamometer, furnished with a vertical column of mercury that constantly indicates by its height on a scale the ascensive power of the balloon. One mounts to the car by means of a moveable footbridge, and twelve to fifteen persons can find places at each ascension.

The cable descends to the bottom of a cistern sunk in the ground ; it turns around a sheave of wrought-iron, mounted upon a wrought iron pendant, and then passes through a properly protected trench and over a system of rollers to a strong windlass, faced with hard wood and with arms and centre of iron, around which it is wound and unwound. The windlass is worked by a double engine of independent gearing, capable of winding in the cable at the rate of fully 350 feet per minute. The cable is 1,200 feet long.

WEIGHT OF THE BALLOON.

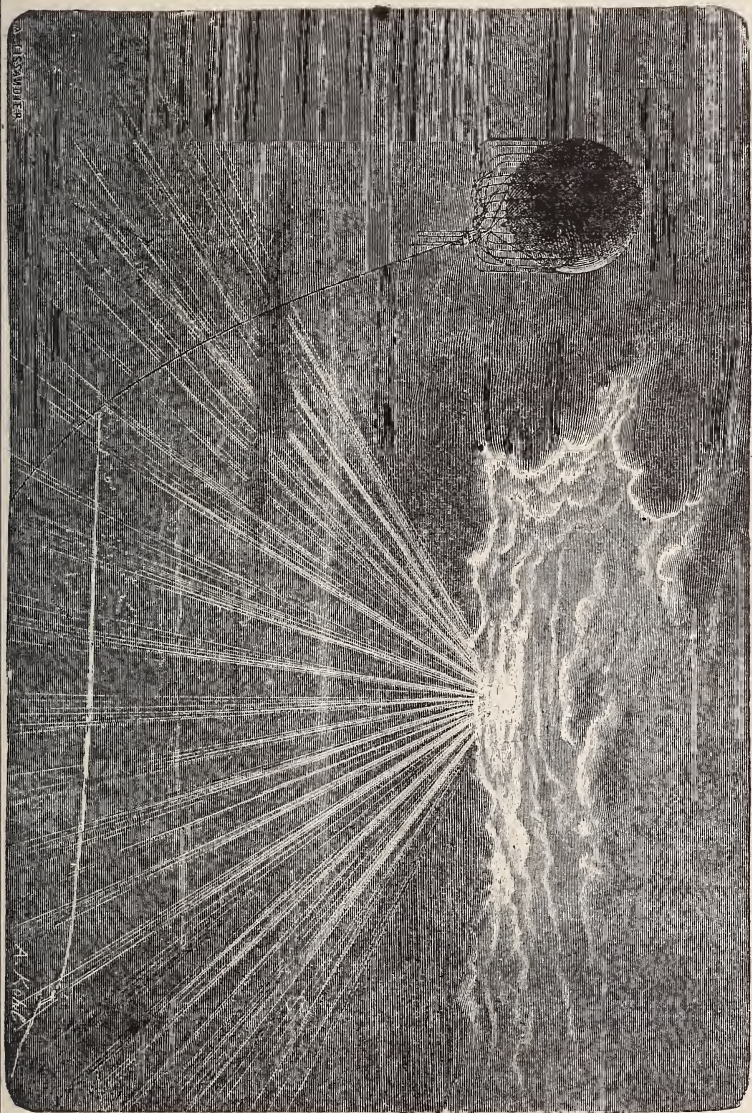
Below are given the weights of the different parts of the balloon :

	LBS.
Cloth of the Balloon.....	1,980
The two valves.....	78
Netting.....	821
The two rings	47
The dynamometer.....	85
The car and its cargo.....	526
<hr/>	
Total of fixed material.....	3,537 lbs.
Cable, 1,200 feet.....	888 lbs.
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Total	4,425
The total ascensional force of the gas contained in the balloon, filled to its utmost.....	10,080 lbs.
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Net ascensive force.....	5,655

From which is to be deducted the combined weight of the aeronaut and passengers to give the actual net ascensive power of the balloon at each ascension.

OTHER STATISTICS.

Diameter of aerostatic sphere.....	65 feet
Its circumference.....	204.20 feet



Volume.....	144,000 cubic feet.
Total height from the surface of the ground to the top of the balloon, resting on the ground.....	95 feet.
Circumference of the car.....	36 feet.
The dynamometer indicates up to.....	10,000 lbs.
The breaking strain of the cable is.....	18,000 lbs.
The capacity of the engine is.....	25 horse power.
The capacity of the boiler is.....	30 horse power.
The capacity of the gas works is.....	20,000 cubic feet per hour.
The sand-bags weigh, filled, each.....	100 lbs.
Diameter of amphitheatre.....	200 feet.
Height of amphitheatre.....	35 feet.
Quantity of linen used.....	8,776 yards.
Number of stitches in each balloon.....	9,706,112
Number of yards of sewing in each balloon.....	16,850

THE CLOTH.

Very many experiments were made before the material was selected. All available fabrics, from cotton cloth to the best silk, were subjected to every test applied in actual balloon service, and with many different kinds of varnish. The finest Irish linen was finally chosen as the best for the purpose. The balloon, from its crown to a little more than half way down, is doubled, the outer coating of the heaviest linen made. The inner lining and the lower half are of a lighter, but very fine material. The cloth was purchased of A. T. Stewart & Co., and shipped to a large hall on Lancaster avenue, in Philadelphia, where it was cut and sewed. The place was admirably adapted for the purpose. The interior, about 130 by 65 feet, had been used for a dance hall, and its clean and neatly waxed floor greatly facilitated the work of construction. Here a deal table 108 feet long and 6 feet wide was set up, and the cloth laid upon it in strips 24 thick, reaching from end to end. The material was first stretched very tightly both ways, to ensure its strength and prevent shrinkage, and then the pattern was laid on and the strips were cut out. These strips were then placed in the hands of the sewing women, of whom there were about fifty, each operating a Singer machine. They sewed the strips together, doubling them at the seams, and at suitable distances apart stays of linen of double thickness were sewed on transversely, the object being to secure greater strength and prevent ripping. These strips were united until they formed altogether eight segments, four of which, when put together longitudinally, represented one-half of the balloon. The sewing was done with the best white silk and with the finest French sewing cotton. Nearly 9,000 yards of linen were used in the construction of both balloons.

The silk used was machine twist, Corticelli and Belding Brothers'

makés. The quality was of the best, and the size letter C, one ounce spools. Twenty-four pounds of this twist were used in sewing. The cotton was of the imported *Fil de Lile* brand, made with a peculiar left hand twist and of excellent finish and great strength. It was six cord and was furnished in 500 yard spools, No. 100 French, which is equal to No. 36 English. Of this 216 spools were used. Very nearly 10,000,000 stitches of the machine were taken to complete the sewing of each balloon.

When the segments of the balloon were joined together, the balloon being in two parts, each half was successively laid out on the floor and ornamented. For this purpose the best colors were selected and specially prepared. All unnecessary accession of weight was avoided, and no chemicals were used that might, by contact with the material, weaken it or injure its fabric. The design was prepared by a skilled artist and carefully laid out to scale. The whole surface was lined out with papier mache patterns, and great exactness was of course necessary in laying on the design. The black band containing the name is 12 feet wide, and each of the letters is 8 feet high. An appropriate medallion fills out the space not occupied by the letters. On *The Pioneer* Columbus is represented on his voyage of discovery, while on either side are allegorical representations of Europe and America, with a Boreas in profile. The medallion of *The Atlantic* represents, in an allegorical form, the voyage of the balloon across the ocean, and the aerostat's triumph over Neptune.

VARNISHING.

Meanwhile the varnish had been undergoing special preparation, a tedious operation, involving much time. The basis of this mixture was linseed oil, but it was associated with other ingredients, the whole according to a formula in the exclusive possession of Professor King, and constituting a coating which has been found to be far superior, in point of durability and impermeability, to any other yet applied. This varnish was sent in barrels to Manhattan Beach, and here the coatings four in number were applied, three to the inside and one to the outside. This operation occupied several days, as each coating required to be thoroughly dry before another could be applied. Fifteen barrels of varnish and naphtha were used. When the several coats had been applied the two halves of the balloon were joined together by sewing, and the seams thoroughly covered with varnish. The envelope was now complete.

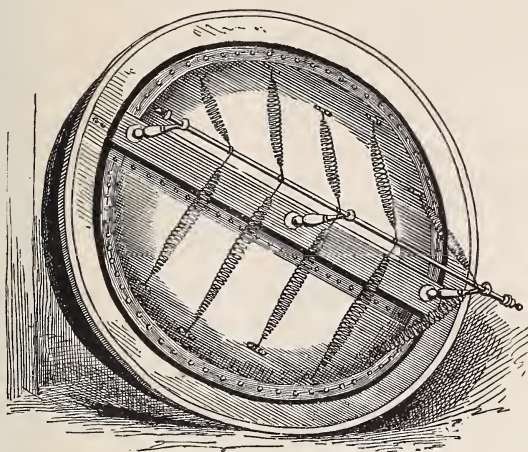
THE NETTING.

The material used in the main netting was a cotton cord one-quarter of an inch in diameter. The breaking weight of this cord was 310 pounds,

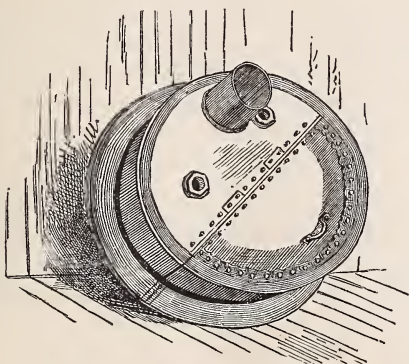
abundantly ample when we consider that the whole net consists of more than 25,000 meshes, on which the strain is equally distributed. The weaving of the net was done by sailors, weaving a mesh perfectly tight, that will not slip in the least, and forms a knot that is flat and soft, and cannot wear the surface of the balloon. The work of making the net began by stretching a rope from one side of the work-room across to the other, and on this rope 250 loops or meshes were woven, constituting the top of the net. The meshes at this point were four inches across, when spread out as they lie on the surface of the balloon. From this point down the meshes increased in size with each row, until just below where they would cover the balloon at its greatest diameter they were sixteen inches across. At this point the net was divided into strips or fringes, each composed of a proper number of meshes, and gradually tapering down to 31 ends, on which the entire strength of the netting was equally distributed. To each of these ends was fastened a manilla rope one-half inch in diameter. These 31 ropes extended down and were firmly united to the concentrating ring below the neck of the balloon. In addition to the 31 strips or fringes mentioned, another row of 31 ropes was attached to the netting at some distance above. To the ends of these, 31 one-half inch manilla ropes were attached for the purpose of securing the balloon to the 31 windlasses hereafter described. These last named ropes of course are necessary only to a balloon used as a captive. The total weight of the net proper, independent of the supporting ropes, is 417 pounds for each balloon. The cordage of the captive balloon, is, however, far from complete with the network thus described. Balloons ordinarily have but one net; but as a means of obviating all strain upon the main net when the balloon is secured to the earth, an extra netting has been provided for each balloon. This extra net or harness rests under the main net, and is made of cotton webbing, an inch and a half wide. The breaking strain of the webbing material is 310 pounds. The strips are sewed together diagonally, and the meshes are made considerably larger than those of the main network. At its lower part the net is furnished with 19 ropes which fasten to the concentrating ring, thus constituting a reserve net that can be used whenever desired to relieve the main netting from all strain upon it. The weight of the whole network is 821 pounds.

THE VALVES

are made of copper, and were attached when the two hemispheres of the balloon were joined together. They are of exquisite workmanship. Their form is circular, and they are attached to the balloon by a col-



THE UPPER VALVE.



THE LOWER VALVE.

lar of leather, into which is sewed a ring of rope. The upper valve is 36 inches in diameter, and weighs $53\frac{1}{2}$ pounds. It has two lids attached by hinges to a centre piece. Five spiral springs of German silver hold each lid firmly to the edges by means of a copper bar fastened to each side, and extending across the valve horizontally at a height of 7 inches above the upper surface. The lids of the valve are covered at their edges with prepared sheepskin or meter leather, fastened to the lid with 158 brass screws, which are kept in place with nuts of the same material. The whole forms a perfectly gas-tight joint.

To the upper valve was attached a cord which hangs down through the center of the sphere and through the lower valve to the car, where it is always within instant reach of the aeronaut. The opening of the lid of this valve would admit of the escape of all the gas contained in the balloon in a very short time.

The lower valve is kept closed to prevent the unnecessary escape of gas and the admission of air. It is so arranged as to open automatically under very slight pressure from the gas within. It is 24 inches in diameter, and edged with leather held in position by 48 brass screws. It has one lid and three springs of German silver keep it closed. Near where the lid is hinged the inflating hose and the collapsing and valve cords enter the balloon. The weight of this valve is 25 pounds.

THE DYNAMOMETER.

This important adjunct constitutes a ponderous steel-yard, five feet in length, which enables the aeronaut to see at a glance just what the ascensive power of the aerostat is, and to note the variations from hour to hour and day to day, due to atmospheric changes, and to the loss of gas. It is made to resist a force of 25,000 pounds, and is marked to register 10,000 pounds. The instrument is in appearance a long, narrow cylinder, provided with a ring-bolt one inch thick at each end. The shell of the dynamometer is wrought of the best angle iron, one-quarter inch thick. The scale of measurement is three feet, and the height of the whole apparatus is five feet. The internal construction consists of a heavy cylinder head, bored on its upper side $\frac{1}{4}$ inch deep and of a diameter for the reception of a 6-inch piston, provided with sheet-packing to prevent leakage of the glycerine employed between the piston and cylinder-head. A $1\frac{1}{2}$ inch diameter steel piston-rod connected with the piston projects through the cylinder-head and is provided with the large brass ring on its outer end for the reception of the captive rope: this piston-rod is packed with hydraulic packing to prevent leakage; when any strain is brought upon the piston by pulling upon the

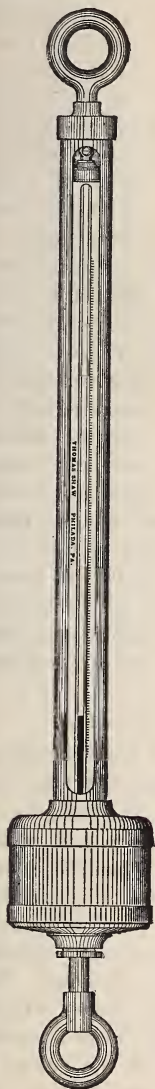
piston-rod the entire weight rests solidly upon a fluid without motion, but pressure is exerted upon the fluid in proportion to the load, which furnishes a means of measurement by employing a mercurial column to balance the pressure exerted on the piston. The mercurial column then rises in the glass tube which the shell incloses in proportion to the pressure exerted, and is more sensitive to pressure, and will move quicker than a scale beam.

The dynamometer was laid off by one of Reihle's heavy scale-beams, the heavy strain being exerted between 12 by 12 timbers, 15 feet high, and 4 feet between timbers. The cross-beams top and bottom were of similar size; screw-jacks on the top timber held in suspension the weighing beam, on the lower hook of which the instrument was suspended; the bottom eye-bolt being secured to the bottom timber. When the beam was elevated by the screw-jacks a strain was exerted on the instrument, and weighed by it accurately. The instrument was marked accordingly. This was the completing act in constructing this compact instrument for automatically pointing instantly to the exact amount of strain exerted. The dynamometer weighs 85 pounds. The upper ring is secured to a rope $1\frac{1}{2}$ inches in diameter, which is attached by four smaller ropes to the main concentrating ring. To the lower ring of the steelyard the cable that holds the balloon captive is firmly fastened.

THE CABLE SHEAVE.

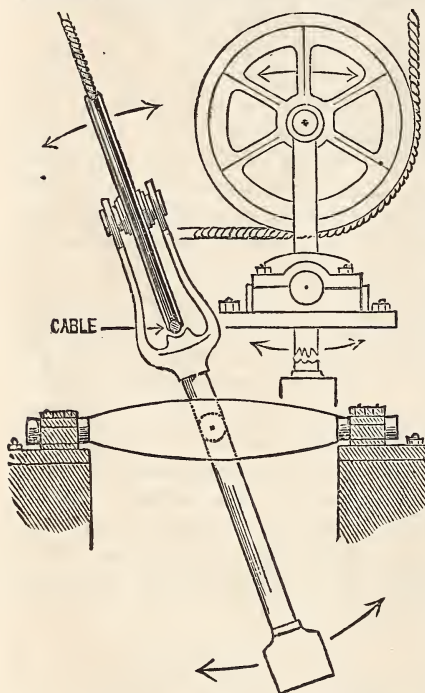
The cable sheave is placed in the exact centre of the inclosure. The supporting frame is made of the very best Ulster iron. It is mounted on an axis of double articulation, which permits it to turn in every direction to follow all the movements of the cable. This result is obtained by the movement of an universal joint, and by the rotation of its roller. The pulley is balanced by a counter-weight in such a way as to prevent any disturbance of the established equilibrium. The

sheave wheel measures thirty inches in diameter; the entire apparatus is 7



THE DYNAMOMETER.

feet in length, and its weight is about 1,100 pounds. It is attached to the ground with thoroughly proven solidity, being bolted to two beams of wood, which in turn are bolted to two others, crossing at right angles, and all four imbedded in solid masonry. This masonry, circular in form, 16 inches thick, and inclosing a well-like space five feet in diameter, was built upon a foundation or templet of beams, to which it is securely bolted, the bolts extending from the surface clear to the bottom. The best cement was used in its construction, and it is to all intent a



THE CABLE SHEAVE.

ordered in duplicate from the New Bedford Cordage Company, who were instructed to make it specially, in the best possible manner, without regard to expense. It is made of the choicest selected manilla hemp, the fibre being exceedingly long and uniform. The strands are three in number, each consisting of 74 smaller strands, and are rope laid. Its diameter is $1\frac{1}{2}$ inches, its weight is 888 pounds, and its breaking strain 18,000 pounds, as tested at the School of Mines, Columbia College. As it was manufactured, two insulated copper wires were carefully woven in with the strands, extending the

huge solid mass of brick, seven feet in height and weighing 50,000 pounds. It was built on the surface, and after it was finished, the centre was dug out and it was sunk until the required depth was reached, when the interior was concreted and cemented so that the bottom was made perfectly watertight. The apparatus is sunk in the ground to such a depth that no portion of it is above the surface. By this means, the aerostat can be brought close to the earth and there fastened in case of a very high wind.

THE CABLE

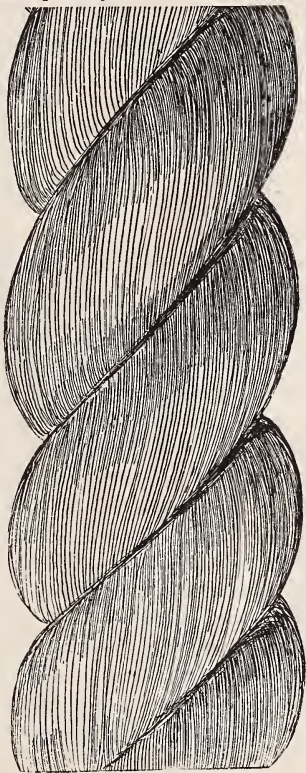
designed for the captives was at first 1,200 feet long; but it stretches gradually by use and will finally gain nearly one-tenth in length. It was

whole length of the cable, for the purpose of forming a telephonic connection between the aeronaut in the balloon and the engineer at the engine.

THE AMPHITHEATRE,

which surrounds the balloon, was provided as an effectual means of shelter against the violent winds that frequently prevail on the coast, and which, without this protection, would speedily wreck the aerostat.

This inclosure is exactly circular in form, and stands 300 feet east of the Manhattan Beach Hotel. The hotel on the west, the bathing houses on the south, the picnic pavilion, to the southeast, and the ice house and servants' building to the north, all contribute to break the force of the wind, and render the shelter more perfect. The circle inclosed is one of 200 feet diameter. Fifty-two trusses, placed at equal distances apart, and planted upon firm foundations, rise to a height of thirty-five feet. They are very strongly built of spruce, with pine cross-pieces, and the entire framework is keyed, spiked, and bolted together. On the outside of these the sheathing is nailed, of smooth pine boards, tongued and grooved, and rising to the summit of the trusses. This forms a very strong, compact, inclosure. On the top a rail rests rounded and made perfectly smooth to prevent abrasion of the cable, in case the wind should deflect the balloon, when afloat, sufficiently near the horizon to cause the cable to rest upon the summit of the inclosure. Around



THE CABLE—EXACT SIZE.

the interior, twelve feet from the ground, runs a gallery with a railing, in front and seats at the back. From this gallery—reached by broad stairs of easy ascent, and forming a delightful promenade—an admirable view of the balloon and apparatus is obtainable. In the center of the inclosure a space 61 feet in diameter is reserved for handling the balloon, but surrounding this the rest of the interior is covered with a planking of spruce, for the better convenience of the spectators

Under the gallery is another row of seats for the convenience of visitors, and near the entrance are the offices of the manager, the aeronaut's room, and a reception room, and near the engine yard are sleeping apartments for the assistants.

All of this part of the work was executed in a very satisfactory and workmanlike manner by Messrs. S. V. and S. T. Hollister, builders, of Elizabeth, N. J. Over 300,000 feet of lumber and 5,500 pounds of nails, colts and spikes were used in constructing the amphitheatre. The exterior is neatly painted, 2,512 pounds of paint being required for the purpose.

THE ENGINE YARD.

Extending from the amphitheatre on the north side is a smaller inclosure, 40 by 80 feet in extent, surrounded by a fence 10 feet high. This contains the engine, boiler, windlass, gas works, coal bins, etc. A planked walk leads from the main inclosure to the apparatus in the yard, and the spectators have an opportunity of closely inspecting everything. Adjoining the engine is the eating house, a separate structure, comprising kitchen, dining, store and sleeping rooms.

THE WINDLASS

is placed in the engine yard at a distance of 125 feet from the pulley. It is 14 feet in length, and is provided with a double set of pinions and wheels, each of which is of ample strength for the purpose designed. The diameter of the windlass is 4 feet. The axle is of the best wrought iron, 5 inches in diameter. This axle supports 5 iron wheels, 3 feet apart. Around these wheels are firmly secured planks of maple, 5 inches thick and 8 inches wide, turned so as to form a perfect circle. The mounted windlass presents the appearance of a huge spool, the surface of which is creased with a spiral, into which the cable coils. There are around the windlass 100 spiral turns. At its extremity, the windlass is secured by bolts and screws to the large spur wheels. It is mounted upon two heavy metal bearings, supported upon strong beams securely fastened to masonry which extends down to the firm foundation of wet sand.

The boiler is of the upright tubular form, eight and a half feet high, and three feet six inches in diameter. It has 85 two-inch flues, and is tested to a pressure of 150 pounds to the square inch by the Hartford Steam Boiler Inspection and Insurance Company. Its capacity is 30 horse power. This stands 10 feet behind the windlass, and its capacity is greatly in excess of the anticipated demands upon it.

The engine, placed in front of the windlass, puts it in motion by the intermediation of toothed pinions, which act upon the spur wheels. It has two cylinders, and is arranged to work very rapidly.

The cylinders are of eight inches diameter, and have a stroke of ten inches. By the manner of construction of the engine, a dead centre is rendered impossible, and the movement is rendered perfectly steady. The engine has 25 horse power.

An ingenious appliance provides the engine with an automatic check, which begins to work as the balloon approaches the extremity of its ascension. Little by little, the ascent is arrested, and without the rude movement which, in the long run, would damage the cable. This stop is made automatically, without any movement on the part of the engineer.

This admirable apparatus is also provided with an automatic safety brake, which encircles a large brake wheel. By its action the movement of the windlass can be at any time instantly checked by very slight pressure upon a lever within instant reach of the engineer.

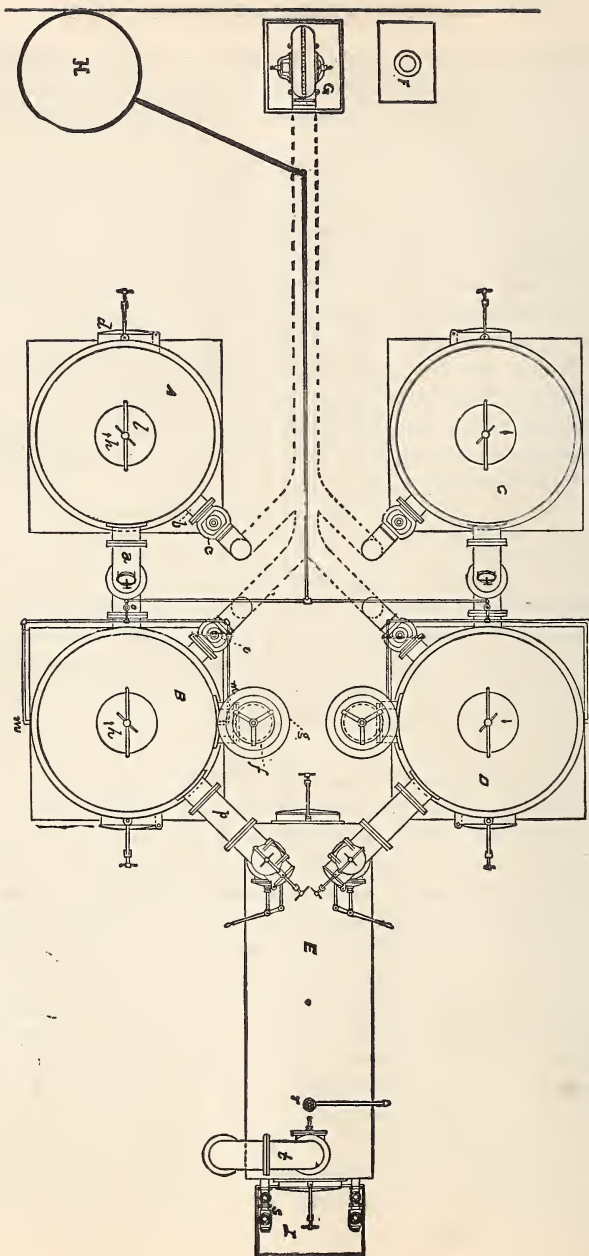
The construction of the engine, windlass and pulley was executed by the well known firm of Otis Brothers & Co., manufacturers of elevators, of 348 Broadway.

THE GAS APPARATUS.

The cuts on pages xxiv and xxv give, on a scale of 3-16 of an inch to the foot, an exact and complete plan of the apparatus in which is generated the gas that gives the captive balloon its ascensive power.

The essential parts of the system are the four great cylinders, A, B, C, and D. These are each five feet in diameter and eleven feet nine inches in height. The cylinders B and D have each a wrought iron stack through which the products of combustion pass to the open air above.

The shells of the cylinders are made of Pennsylvania charcoal hammered iron, and the heads are of the best flange iron, hand-riveted throughout. They are made in sections of about eighteen inches each in height, so that, if it is desired at any time to increase the capacity of the apparatus, one or more additional sections can readily be added, and at small expense. At the top and bottom of each section an angle iron ring is riveted, thus forming flanges, which are all drilled to a gauge. The joints are made with a preparation of red lead and iron filings, and the flanges are then bolted together, making a completely air-tight cylinder of symmetrical appearance. Each of these cylinders is lined with refractory fire brick. A space is left between the shells and the back part of fire brick, which is filled with thoroughly burned and well sifted wood ashes, the best incombustible non-conductor of heat known; its conducting power, according to the experiments of Péclet, being .531 as compared with 4.83 for ordinary brick-work. The fire-brick was made



THE GAS WORKS—GROUND PLAN.

especially for these works, and, with the kaolin with which the joints are made, weigh over 32,000 pounds.

This great weight required solid foundations. The surface sand was dug away until there was reached the underlying perpetually wet sand, which is almost as hard and firm as clay. On this wet sand were laid two courses, crossed, of spruce timbers, 3 inches by 12 inches, and on these solid and massive red brick piers were erected, the bricks being laid in hydraulic cement. Each pier or foundation is 5 feet 4 inches square, and 5 feet 6 inches deep.

Figure 1 gives a plan of the works, and Figure 2 shows a side view of the entire apparatus, except the gas holder, and the underground pipes leading therefrom to the vicinity of the balloon.

The chambers A and C are called the "producers," while the chambers B and D constitute the "re-heaters." There is also at E a condensing chamber, 3 feet 6 inches wide, 2 feet 6 inches high, and 10 feet 2 inches long. It is made of charcoal hammered iron, and provided with a similar foundation to the cylinders mentioned above. F is a substantial vertical steam engine, of 6 inch bore and 8 inch stroke, with an automatic cut-off, actuated by a very novel governor. G is a high-speed, noiseless rotary fan for supplying air to the producers and re-heaters. H is a thirty-horse power steam boiler, for supplying steam to the re-heaters, and to the vertical engine.

As soon as the works were completed a fire was started in each of the producers A and C, and kept burning slowly for several days, so as to gradually dry the fire brick linings. This being accomplished, the works were ready for generating the hydrogen gas. The process, which is very simple when comprehended, though seemingly complicated at first sight, is as follows:

A bed of fuel is built up in the producers A and C to a point a few inches below the outlet pipe *a*. The fuel may consist of a low grade of anthracite coal, or coal dust, or coke, or peat, according to the cheapness and convenience with which either can be obtained. The fuel in producer A is brought to an incandescent state by means of an air blast from the fan G, which enters by the wrought iron blast pipe (6 inches in diameter) at *b*, regulated by the valve *c*. This delivers the air, at a pressure of about 5 inches water column, under the grate bars, which are on a line with the centre of the ash door *d*. The combustion being rapid, carbonic oxide gas is generated in large quantities by the union of the oxygen of the air with the carbon of the fuel. Nitrogen gas is also disengaged, but being inert, no account of it is taken. The carbonic oxide passes by the cast iron conducting pipe *a*, (which is 8 inches in diameter), to the bottom of the re-heater B, which is filled with

a preparation of iron, and there burned, and, by contact with the gas, the iron is chemically changed and brought into a highly heated condition, the products of combustion passing off through the valve *f* and stack *g* to the open air. The letters *h h* show the location of peep valves, arranged with glass caps for protecting the eye, and through which, by turning the valve, the condition of the interior of both producer and re-heater can be ascertained.

The air blast to the re-heater is regulated by the valve *i* so as to produce perfect combustion of the carbonic oxide. When the temperature of the preparation has been raised to the proper point, the air blast valves *c* and *i* are closed, and also the valve *f*. The works are now air tight. Valve *k* is closed to prevent any more carbonic oxide gas coming over from the producer, and the lid *l* is laid off part way to allow the gases from the fuel to pass off. Steam at 90 pounds pressure is now introduced into the re-heater at points *m m*, being regulated by valve *o*. By the aid of the super-heated preparation the hydrogen is disengaged and passes in large volume by the 8 inch conducting pipe *p* to the condensing chamber E, which is nearly filled with water, a constant stream running in at *r* and overflowing by pipe *s* to the hydraulic seal I, which also has a suitable overflow. The hydrogen gas being cooled and condensed in chamber E, as well also as purified of foreign particles mechanically suspended in it, now passes by the 8 inch cast iron conducting pipe *t* to the holder, the end of the inlet pipe to which has the form of a goose neck, and dips into the water about two feet, its end and sides being also drilled full of $\frac{1}{4}$ -inch holes, so that a large surface of the gas is again exposed to the cooling action of the water. From the holder runs a delivery pipe eight inches in diameter in the shape of the letter S for 200 feet, about four feet below the surface and in contact with the wet sand. By this means the flowing gas is further cooled and dried, so that it enters the balloon in the best condition for the aeronaut's use. The delivery pipe is brought to the surface at a distance of about 30 feet from the balloon. A valve is here placed to permit or check the flow of gas, and a linen hose is attached to the mouth of the pipe and to the neck of the balloon whenever a supply of gas is desired. *u u u* are three water column pressure gauges, connected by wrought iron pipes to the re-heaters and condenser. They serve to indicate the pressure in the different parts of the apparatus, give warning of any derangement in the working of the process and also of the proper time for changing the valves. When this is indicated, the steam valve *o* is closed, the valve *f* is raised, the valve *k* is opened, the lid *l* is removed, and more fuel thrown into the producer, when the lid is replaced and clamped into position. The air

blast valves *c* and *z* are then opened and the gas making proceeds as before. While gas is being delivered from the re-heater B, the producer C and the re-heater D are going through the process of heating up; and by the time the re-heater B has cooled off the re-heater D will be ready for a run of gas. Thus the sets are alternately making and so a continuous flow of gas is secured for the balloon.

The works will produce over twenty thousand (20,000) feet of gas per hour, and the ease of operating them is such that a man and a boy are the only attendants required, and their time is by no means fully occupied.

When a sufficient quantity of gas has been made, the fire can be banked up and the apparatus put on natural draft for a number of days, if desired, and when again needed can be making gas inside of an hour's time.

There are many novel and interesting matters of detail in connection with the gas works, but it is not necessary to speak of them here, as our object has only been to briefly give a general idea of the apparatus and its product. The apparatus was furnished and erected by A. O. Granger & Co., engineers and contractors of Philadelphia. The construction is in every respect creditable to them.

“THE DUTCHMEN.”

The visitor to the amphitheatre observes a series of windlasses surrounding the balloon and secured to a frame-work of massive timbers sunk in the ground. The anchorage is of that construction commonly termed a “dutchman.” These windlasses are 31 in number and are placed at equal distances apart on the line of a circle, the center of which is the exact centre of the amphitheatre. This circle has a diameter 5 feet greater than that of the balloon, fully inflated. The office of the windlasses is to draw the balloon down close to the earth and there secure it whenever the wind is violent. The balloon inflated and in working order, with its car attached, rises to a height of — feet from the ground, and in case of a high wind, nearly the entire sphere would be above the level of the walls of the amphitheatre. To prevent the swaying of the aerostat in obedience to the pressure exerted by such a wind, the car is detached, the thirty-one ropes attached to the net work are made fast to the windlasses, which are manned by the assistants, and the balloon is thus lowered very quickly and easily a position of safety. This entirely new device for protecting the balloon was demanded by reason of the peculiarly exposed location selected on the border of the ocean.

THE CONCENTRATING RING.

The concentrating ring, so styled because upon it is concentrated all the tension exerted by the balloon in one direction, and in the other by the weight of the car and the cable, or anchor, is a hoop of tubular wrought iron one and one-half inch in thickness, firmly welded together. Its diameter is thirty inches and its weight is twenty-four pounds. Resting upon this is a ring of manilla rope of equal circumference, and one and one-fourth inches in diameter. The car, net, and cable ropes encircle both rings.

At a distance of three feet below the concentrating ring is another hoop of iron one inch thick, four feet in diameter and weighing twenty-three pounds. This ring serves to prevent too great an inclination of the ropes that sustain the car, and to render the car itself more firm.

THE TRENCH

through which runs the cable is 123 feet long, and deepens gradually until at the centre of the inclosure where it connects with the sheave anchorage its depth is five feet.

THE TELEPHONE.

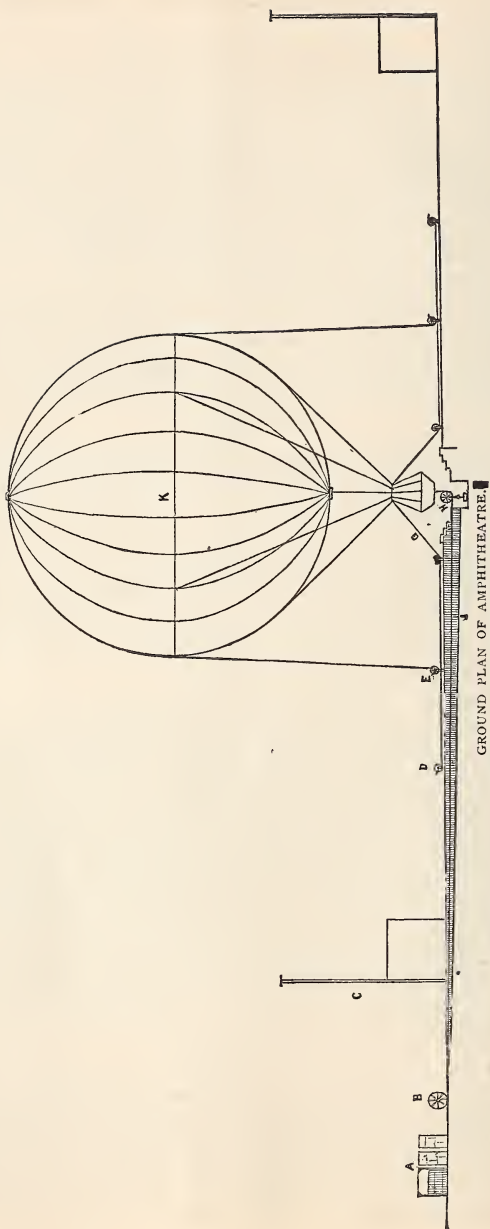
A perfect telephonic connection with the balloon is secured by means of insulated wires woven in with the cable. This appliance enables the aeronaut to communicate at any moment with the Engineer, and to transmit to him any requisite direction.

THE SYSTEM OF ANCHORAGE.

The place by which the cable sheave is rendered secure has already been described. The accompanying sketch shows the system by which the Captive is anchored and protected against the storms and squalls which are liable to spring up at any time. In the sketch, A indicates the position of the gas works; B is the windlass; J is the trench through which the cable passes; C represents the wall of the amphitheatre; D is one of the four windlasses to which the Captive is attached when resting between the ascensions. E is one of the 31 winches that are placed at equal distances apart surrounding the Captive for the purpose of drawing it down and firmly holding it during a high wind.

INFLATION.

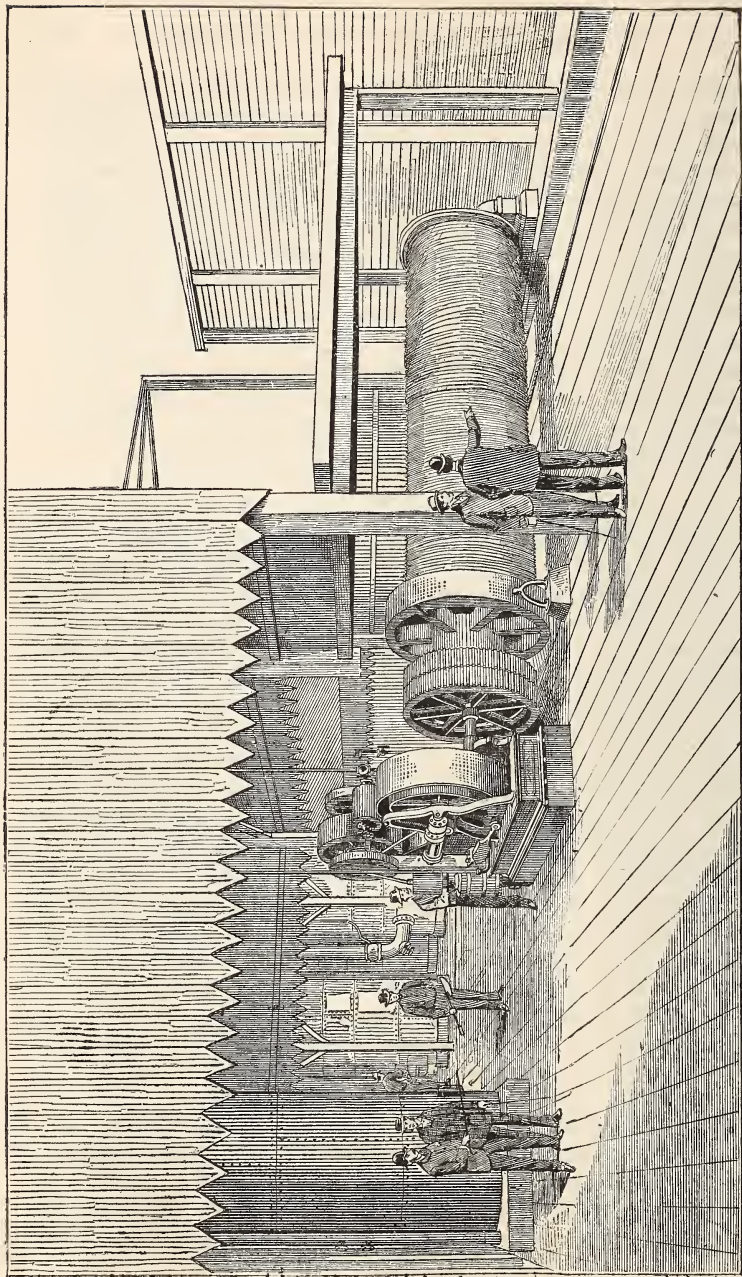
The process of inflation was very difficult and delicate, and exceedingly interesting. The netting was placed over the balloon and joined at the crown to a circle of ropes surrounding the upper valve. The balloon, covered with the netting, was then spread out in the centre of the inclosure upon a ground cloth, to protect it, and the gas valve was



opened, a hose leading from the end of the gas pipe into the neck of the sphere. The network of the balloon was furnished with equatorial cords, which kept it in a regular position. When once the upper part of the sphere arose above the surface of the earth, sand bags were attached by hooks to the meshes of the net, entirely around the balloon and at equal distances apart. As the inflation progressed the bags were attached to the next lower line of meshes, and thus the balloon gradually lifted itself from the ground. Guy ropes fastened to the netting at different points to equalize the strain contributed to keep the sphere steady and immovable. The sacks of ballast numbered 300, and, filled with sand, weighed each 100 pounds. The inflation of the balloon began on the evening of June 28, at 10 minutes to 9, and terminated on July 1, at 4:30 P. M., the process being accomplished with mathematical precision, and without the least accident.

THE ASCENT.

The balloon is fixed to the earth by its four mooring cables. The assistants prepare to detach them. The foot bridge rests upon the rim of the basket, ten or fifteen voyagers traverse it, take their places in the car, the bridge is drawn back, the aeronaut gives the signal, and the aerostat rises with the lightness of a swallow. One mounts without trembling; the earth sinks into the distance, the picture below of the land and the ocean is presented to the eye, and the horizon of the neighboring fields soon opens into a gorgeous panorama in an immense circle of more than 60 miles in diameter. The whole coast line is visible, across to the north the Jersey shore, the land from Sandy Hook to away below Long Branch is seen, the threadlike course of the Shrewsbury, Red Bank, then Staten Island, the Kills, the bay beyond, Newark, Jersey City, the whole of Brooklyn and New York, and beyond the Hudson and the Palisades, while nearly due north the sail-studded waters of Long Island Sound stretch out beyond the eye's range. It is a glorious panorama that one contemplates at the extremity of the cable, but this panorama is always new and always changing in aspects, because the atmosphere is like a kaleidoscope which transforms infinitely the same images. The city of New York appears in a thousand different graces. Sometimes it is gilded by the fires of the ardent sun; again it is painted in a uniform tone which gives it an aspect more severe but not less grand; again it disappears in the fog or haze, and then it resembles those great decorations in the theater which they soften by covering them with a muslin veil. An ascent serves to modify entirely one's ideas as to the topography of the country under view, no matter how familiar every location may be.



ENGINE, WINDLASS AND GAS WORKS.

The birds-eye view from this elevation gives the relative situation correctly, and one is astonished to see how different the reality is from the map that had been drawn mentally.

Beautiful, however, as is the ascent in the day time, it is far surpassed by the enjoyment of a night voyage. The air is calm, and the voyager seems to be mounting to a new life. Below, the lights of the hotels glimmer like so many stars; away out on the expanse of water are seen the beacons toward which the mariner is steering; there are the twin beacons on the highlands of Navesink. Yonder are the clustering lights from the more thickly settled portions of Staten Island; the vessels in the bay indicate their whereabouts by their colored signal lamps, and away yonder to the northwest is Gotham, while further to the right, but nearer, is Brooklyn. The noisy hum of a dense population is not heard at this elevation, but all around is the stillness of the night amid which the grandly beautiful spectacle below is contemplated. The influence created is one never to be effaced.

WHAT WOULD OCCUR IF THE CABLE SHOULD BREAK.

Only a wind blowing a gale could in any case cause the rupture of the cable. It is scarcely possible that any wind could arise so rapidly that the balloon would be unprepared for it and unable to effect a descent. But let us suppose that by a succession of unforeseen circumstances such an accident should occur; would it be likely that the voyagers, sent unexpectedly out into the air, would become lost?

An explosion of the balloon cannot occur while it is ascending; the gas would escape automatically with such a rapidity that no amount of disturbing pressure could produce it. Everything is arranged so that the aeronaut would have nothing to do but to organize his descent.

As Prof. King is thoroughly versed in the science of aeronautics, as he is also provided with grappling hooks, guide ropes, ballast, &c., he would be able to land with his passengers safely in case the Captive should break free. If the direction of the wind should be oceanward, and he should descend into the water, the basket in itself constitutes a life-raft, and only a few minutes could elapse before the rescue of the party by some one of the many passing craft.

ADVICE TO AERIAL TRAVELERS.

Those contemplating an air voyage in the Captive should choose the hours not when the seasons are serene and clear, but those moments when the clouds are flying, disjointed and oddly shaped. However magnificent may be the view of the earth and the ocean,

that of the celestial vault offers to an artistic eye a superior attraction. The time is all too short to enable the beauties of the scene to be fully appreciated.

But if the panorama, as it lies spread out from this distance, is preferred, it is well to study a plan of it in advance, in order that the different points and objects of interest may be the more easily recognized.

One of the most interesting features of the landscape is the border of the ocean, which winds like a serpent and trails its slow length



far out to the west, northeast and south, while to the east the watery waste meets the horizon, and its surface is dotted with vessels.

If the ascensions occur in a clear day, or at an early hour, the heights bordering the Hudson may be seen at a distance for many miles.

The nocturnal ascensions also are very desirable, as the nights are unusually calm even when the days are stormy, and the spectacle of the illuminated metropolis is still more enchanting, if possible, than that of New York, bright with the mid-day glare.

When the balloon is anchored the differences and changes of temperature can be easily noted. The expansion of the surface of the balloon makes it an approximate measure of the solar heat. No thermometer is more sensitive.

The supplementary ropes which were necessary during the inflation of the balloon are often used in mooring it. But when they are loose the balloon sways gracefully to and fro, making isochronal oscilla-

tions, from which can be calculated the rapidity and the direction of the wind. A balloon thus placed is the best of all anemoneters, and there is no doubt that even if it had a much smaller diameter it would still render invaluable services to meteorology.

THE TESTS.

The public may rely upon it that every part of the material used in the construction of the balloons and their apparatus was thoroughly tested and pronounced safe beyond peradventure, before it was accepted or used. Every measure that experience or ingenuity could suggest has been adopted to secure permanency and successful working. The materials used in the construction of the balloons, and to secure them, after having been approved by the engineer in charge of the construction, were tested at the School of Mines, Columbia College. Every portion of the material was found to sustain a strain many times in excess of any anticipated requirement, even under extraordinary circumstances.

The results of the Columbia College tests, conducted by Prof. Hutton, were as follows :

Of the linen, forming the envelope, a piece 3 feet long and 2 feet in width, tested diagonally, sustained a tension of 390 pounds.

A sample of the webbing used for the reserve net, broke at 310 pounds.

The cotton cord, of which the net was made, broke at 310 pounds.

One of the 31 ropes, attaching the net to the concentrating ring, broke at 1,650 pounds.

One of the 12 larger ropes, used to sustain the basket, broke at 3,600 pounds.

A piece of the rope of which the 12 smaller basket ropes are made, did not break until a strain of 2,200 lbs. has been exerted.

One of the four ropes that hold the Captive when at rest was adjudged to stand a strain of 11,000 lbs. The cable rope was certified by Prof. Hutton as capable of withstanding a tension of 18,000 lbs. Its perfection of construction has been admired by all those skilled in rope manufacture who have seen it.

The above tests were made with Fairbanks' Standard testing machine.

The entire cost of this enterprise, above described, does not fall far short of \$75,000.



THE CAREER OF MR. SAMUEL A. KING.

Mr. Samuel Archer King is a native of Philadelphia, and was born in 1828. Having witnessed some of the aeronauts in his native city, he became interested in the subject, resolved upon attempting something of the kind himself, and accordingly built a balloon with which he ascended from the Zoological Gardens at Fairmount, September 25, 1851. He soon after made other ascensions, speedily attaining eminence in his profession. He made numerous voyages from Philadelphia and other places in Pennsylvania and New Jersey during the early part of his career. In 1855 Mr. King made several fine ascensions from Wilmington, Delaware. June 16, 1856, he ascended from Wilkesbarre, Pennsylvania, and in descending was carried by a contrary current of wind into some tree tops, where his balloon was torn to pieces, and he was dashed to the earth a distance of some forty feet. He was rendered insensible but fortunately not much hurt.

In 1856 and 1857 Mr. King made several ascensions from Providence, R. I., and other places, including one from New Haven, Connecticut, August 15, 1857. On this latter occasion he took up two gentlemen of that city in the balloon *Queen of the Air*, which afterwards became famous in his ascensions from Boston. The balloon took a southerly direction, and to prevent it from going to sea was landed in Long Island Sound, off Stony Creek, the passengers being completely submerged at the first dip. It was subsequently brought to anchor on Governor's Island, the party having experienced no further damage than a good soaking. There was a somewhat singular incident in connection with this trip. At Douglas's Hotel, Stony Creek, a popular seaside resort, it was the custom to put up a comic bulletin every day for the amusement of the guests, detailing what was going to happen on that date. On this bulletin it was appointed that the balloon should come that way, land on Governor's Island (which is one of the so-called Thimble Islands), and that the passengers should be brought on shore by a particular yacht; all of which predictions strangely enough proved true. During the year 1857 Mr. King also made ascensions from Norwich, Connecticut, and Lowell, Massachusetts; and during the following year he paid professional visits to

Lowell, Mass. ; Manchester, N. H. ; New Haven, Conn. ; and Dover, N. H. ; besides making further ascensions from Providence, R. I. A voyage from Paterson, made August 6th, was quite a remarkable one. Mr. King was accompanied by Mr. Allen, a pupil of his, and after journeying from Paterson to New York, landed in Central Park. After having a short chat with the Gothamites, the voyagers again ascended, and this time landed near Hiram Woodruff's place, on Long Island.

At the time of his New Haven ascension, September 1, 1858, he availed himself of a favorable opportunity that presented itself, to make some experiments with the drag-rope, which Green, the English aeronaut, had contended could be of use as a guide. In starting from New Haven, Mr. King allowed seventy-five pounds of the rope to drag upon the ground, and as the balloon sailed along through the air, the rope rattled merrily over the house-tops and fences. As the balloon gradually became heated by the sun, its ascensive power was increased without discharging ballast, and by the time five miles had been traversed, the rope was lifted entirely from the ground and continued to be lifted until a height of two miles had been reached. After journeying nearly thirty miles, the drag-rope was detached and the aeronaut then continued about the same number of miles further.

June 4, 1859, Mr. King made an ascension at Charlestown, Mass., landing in Belmont. On the succeeding Fourth of July he made an ascension from Boston, in connection with the city celebration, which was the first of a series of engagements by the municipal authorities of that city. July 4, 1869, Mr. King ascended from Boston Common with a party of gentlemen and alighted in Melrose. A large crowd of ladies and gentlemen there received him, and a long rope being procured, he treated some of the former to a bird's eye view of the village by moonlight. While the balloon was in the air with five young ladies and Mr. King, the rope broke and the aerial craft was carried several miles, when it was safely brought to earth again.

The records of Mr. King's ascensions from the papers of the times when they were made are full of interest, and of themselves make a large book. At Buffalo, July 4th, 1868, the company consisted of five persons, three newspaper editors being of the party. The ascension is described as most magnificent, but the balloon was carried out over Lake Erie, where, in the endeavor to navigate it by means of an undercurrent so as to reach the land, the car twice struck the surface of the lake. The aeronaut succeeded, however, in his efforts to reach the land, and then began a splendid voyage over mountain and valley, forest and farm. Once they descended and enjoyed themselves for half an hour with the people of the town of Eden. Ascending again they finally touched the ground on the top of the Alleghany Moun-

tains, at 11 o'clock at night. As they struck the anchor was thrown out, but the balloon rebounded, passing over a tall pine tree the top branches of which caught the anchor. The rope being comparatively short, they were not able to reach the ground; yet, the night being dark and the nature of the ground beneath very uncertain, it was thought best to remain in the tree all night, but when daylight appeared, Mr. King cut loose from the anchor rope, and the balloon landed in safety on the ground.

From Buffalo he went to Rochester, and on Thursday, September 29th, he made a most beautiful ascension from Falls Field. His course lay a little to the north of east, passing over Irondequoit Bay and by the village of Webster. Descending he caught a counter current which carried him back again some miles, and he alighted finally two and a half miles northwest of Webster.

TO THE SNOW REGIONS IN FIVE MINUTES.

October 19th, 1869, he ascended from Rochester again, this time with his balloon, *The Hyperion*. The party consisted of seven persons. The day was very unfavorable, the wind was boisterous, threatening clouds flew across the sky, flurries of snow were frequent, and the cold was searching. The ascent was made from in front of the Court House, among high buildings, and to clear these a great ascensional power was given to the balloon. It was a delicate operation to start under the circumstances with such an immense aerial craft, but one bound cleared it of all obstructions. Not less than fifty thousand persons witnessed the ascension, in spite of the disagreeable weather. In four and a-half minutes, although gas had been discharged from the valve, they entered a snow cloud. They traveled at the rate of about forty miles an hour; the cold was intense, night came on and they were in the midst of a driving snow storm. The weight of snow gathering on top of the balloon drove them to the ground, and they were forced to make a landing in the squall. They struck violently in an open field, the anchor did not hold, and the balloon bounded over a piece of woods, alighting on the other side. Here the anchor held for awhile, the gas escaping from the valve at the same time. Unfortunately, in the excitement, two of the party in some way got out of the basket, and the balloon thus lightened broke loose and bounded upon a side hill and at last was driven against a tree, a huge rent being made in the machine so that the gas escaped almost instantly. They had landed in the town of Cazenovia, three miles from the village of that name. From Rochester Mr. King went to Atlanta, Ga., where he made a fine ascension, December 10th. He was accompanied by Dr. Hape of that place. They traveled north

about forty miles and alighted in a backwoods settlement. In this place scarcely any one had ever heard of a balloon, and a great many were terribly scared. Before they left the vicinity they heard numerous stories of how the inhabitants had been frightened.

There were a number of illicit distilleries in the neighborhood, and the people seeing the aeronauts when they were seeking for a landing-place, took them for revenue officers looking for such concerns, and went for their guns in double quick time, but the balloon did not wait for them. A number of boys going home from a fishing excursion, threw away their fish and ran for dear life. One man going home from mill with a bag of meal on his shoulder, dropped the bag and never stopped running till he reached his house. A large family, consisting of a mother and her daughters, living where the balloon descended, were dreadfully alarmed. The old lady began to pray and the daughters to scream. A farmer who was not scared, hearing the noise, went to see what was the matter. The old lady cried out: "Come here, Mr. Martin! come here, the world is coming to an end! I know it is! and I am glad that I have lived to see the day."

IN A BURSTED BALLOON ONE MILE HIGH.

After this ascension Mr. King leased the balloon to Dr. Hape, who was anxious to make an ascension alone. The time set for the ascent was New Year's Day, January 1, 1870. Mr. King was present at its inflation, and superintended its management. As soon as the car had been attached to the balloon, the doctor got inside, and, before the preparations for the start were completed, suddenly gave the word to "let go." Mr. King was at the time some distance from the car getting more ballast, and was in consequence unable to prevent the premature ascent. There should have been at least two hundred and fifty pounds more of sand in the car to prevent its rising too rapidly. As it was, the balloon shot upward with such great velocity that the spectators became alarmed, and gathering around Mr. King, begged to know what would be the result. He informed them that unless the doctor should have the forethought to open the valve and allow a large quantity of gas to escape the balloon must burst from the sudden expansion of the gas; and, sure enough, when it had scarcely attained the height of one mile, it was suddenly rent from top to bottom, the gas was gone in an instant, and the balloon descended with great rapidity. The audience gazed at the sight with blanched countenances, and could not be convinced that the poor doctor would not be dashed to pieces. Yet within fifteen minutes—mounted on a policeman's horse—he was riding back through the town at full gallop. When the balloon burst it formed itself into a parachute,

and thus met with a sufficient amount of resistance in falling through the air to save the voyager from any serious damage.

February 9th following, Mr. King ascended from Augusta, Ga., sailing in a direction north of east. Crossing the Savannah River into the State of South Carolina, he continued his voyage a distance of one hundred and thirty miles, and after passing over the Santee Swamp, in descending, his balloon was caught by the limbs of a tall pine tree and torn to pieces, the rotten limbs giving way, precipitating the aeronaut a distance of fifty or sixty feet to the ground. The distance was not sufficiently great to allow the torn balloon to form itself into a parachute, and consequently the fall was a severe one, though not so hard, perhaps, as if he had fallen the same distance without the balloon; he was badly bruised, but had no bones broken. March 10th following, our aeronaut made another ascension from Augusta, landing near Bath, S. C. On the 5th of May, the same year, Mr. King ascended from the city of Charleston, S. C. He was accompanied by Walter Steele, of that city. They sailed in a northeastly direction along the coast, and were over the Wando river most of the time. They finally landed twenty-three miles from the city in a rice field. Coming north again on the following 4th of July, he made another ascension from Buffalo with a party of five persons, and after a pleasant voyage landed in the town of Newfane, about three miles north of Lockport. August 28th, an ascension was made by Mr. King, at Rochester, New York, in *The Aurora*. He was accompanied by Mayor Briggs, and after being up fifty minutes landed in a field one-half mile south-west of Parma Centre. September 5th Mr. King ascended from Newburgh, N. Y., and descended at Westport, Conn. His description of the voyage is charming. He had a magnificent view of the Hudson River, Long Island Sound, and the surrounding country. New York City was plainly visible, as well as the Jersey shore, Long Island, and the ocean beyond, and all, or nearly all, of the State of Connecticut. After descending, the gas was retained in the balloon until noon of the next day, and the evening and morning were employed in making captive ascensions, by which a number of the inhabitants of the place were enabled to enjoy a partial balloon ride. September 14th, from the Fair Grounds at Barton, Vt., Mr. King voyaged across the State of New Hampshire, and landed near Swift river in the State of Maine. September 30th he went up from the Fair Ground at Troy, in a pouring rain and landed in the town of Guildenbrand, Albany county, N. Y. October 5th, 1871, Mr. King made an ascension from Plymouth, New Hampshire, in his new balloon, *The Star Spangled Banner*. Upon taken an observation four minutes after leaving the ground it showed that the balloon was

2,771 feet above the level of the sea, or half-a-mile above Plymouth. In a few minutes it headed directly for the White Mountains, having reached an altitude of 3,959 feet. Campton Mountain was passed over when the balloon was 4,870 feet high; and Whiteface Peak was left far below, the balloon at this point reaching a height of 6,144 feet. The air ship descended safely at Bridgton, a distance of forty-three miles from Plymouth. October 14, he ascended from Unionville, N. Y., taking with him as companion Mr. E. M. Hanford of that place. They landed after an exceedingly calm and pleasant voyage, near Warwick, N. Y. On the 24th of the same month Mr. King ascended from Middletown, N. Y. His course lay to the North East. He landed late in the evening at Millerton on the Harlem railroad. A large portion of the voyage was made in the darkness, but before he landed a brilliant display of the Aurora Borealis lighted up the atmosphere and the country beneath him. November 24th (Thanksgiving day) an ascension was made from Ellenville, N. Y., in which Mr. King was accompanied by Mr. A. B. Deming, of Middletown. They descended at Norwalk, Connecticut, having made the distance of 75 miles in an hour and twenty minutes. June 17th, 1871, on the occasion of the anniversary of the Battle of Bunker Hill, Mr. King and Mr. Luther L. Holden, of the Boston *Journal*, ascended from Charlestown, Mass. The wind bore them off in a northeasterly direction toward the ocean, but by watching the currents of air, they were enabled to change their course and finally effected a landing in East Kingston, New Hampshire. This was the seventeenth time that he had been accompanied by Mr. Holden. On the 4th of July following, Mr. King ascended from Chelsea, Mass.

OVER THE OCEAN.

There was a dense fog prevailing at the time, and in a few seconds he was lost to view. He rose above the fog, and remained above it several hours; he knew by the various sounds that he heard, that he was travelling inland, and once he came down into the fog and talked with people below. He could only hear the voices, and they could not see the balloon. During the conversation he succeeded in ascertaining his whereabouts; he was then over North Chelsea and the ocean. It was past eleven o'clock at night when he effected a safe landing in the darkness and fog, six miles northwest of Lowell, Mass.

RESCUED AT SEA.

July 13, 1872, an ascension was made by Mr. King at Boston, when the balloon was carried out over the ocean nearly two miles. Upon signalling to a yacht the guide rope was taken on board and made



fast to the mast. By thus having a rudder at command, the balloon aided the yacht and the latter helped the balloon, one furnishing the steerage and the other acting as a vast sail. In this manner Mr. King landed safely on the beach, forming a pleasant conclusion to what threatened to be a perilous adventure.

September 10, 1872, Mr. King made an ascension from Schenectady, New York.

A WONDERFUL VOYAGE.

On the 26th of Sept., 1872, Mr. King made a notable voyage in company with Mr. Holden. The ascent was made from Plymouth, N.H. The balloon used was a small one, having a capacity of only twenty thousand cubic feet, and at the time of its departure, it was not wholly filled with gas, probably not more than three-quarters full. The buoyancy was, however, much greater than the common illuminating gas would have imparted, as hydrogen gas, manufactured on the ground by Mr. King, was used in the inflation. It was eighteen minutes past four in the afternoon when all connection with the earth was severed, and the balloon quickly winged its way towards the thick black storm-clouds that were drifting directly towards the heart of the mountain region on the verge of which the town of Plymouth lies. Entering the clouds, and for a long time journeying in them, the adventurous voyagers passed through a series of strange experiences. Once they seemed to be in a grotto with walls of clouds on every side, while the gleams of the setting sun found their way to the hidden regions beneath and lighted up the floor of the weird place with a strange, red glare. After sailing through these silent regions at a varying height of from 9,000 to 11,000 feet, the balloon was suffered to descend to within 6,000 feet of the sea level. A strange sight met the gaze of the astonished balloon travelers as they passed below the clouds. They were in close proximity to the high mountain peaks, and below was a deep black chasm, from the recesses of which issued the gentle music of a cascade. The bleak mountain tops, overspread by an inky pall, towered around them in awful grandeur.

It was not yet the hour of sunset, but the dense and murky clouds threw an almost midnight blackness over the scene. A few pounds of sand were thrown out—the first that had been expended—and the balloon cleared the peaks and passed far beyond them before Mr. King and his companion realized that they were drifting at the rate of fifty miles an hour towards the great wilderness of Maine, which was already spread out before them. They flew across the Androscoggin Valley, and soon after six o'clock found themselves drifting rapidly over Umbagog and the string of other lakes which stretches out over the Maine border from the New Hampshire line. The balloon had

taken a direct northeast course and was making for the very heart of the great Maine woods. Mr. Holden continued to take frequent readings of the barometer and thermometers until the gathering gloom rendered it impossible to discern the fine divisions of the instruments. At six minutes past six o'clock the recorded altitude was 5,619 feet, and the temperature 46 degrees, the humidity having reached the saturation point. Lights, some of them marking the camps of lumbermen or hunters, were seen in the early stages of the long, weary night, but the denizens of earth were too distant or too much frightened to heed the hallooing of the belated aerial travelers who were flying over their heads. The situation began to grow serious. A forced descent in a trackless forest, an hundred miles or more from human habitation, with a scanty stock of provisions and without firearms or fishing-tackle with which a fresh supply might be obtained, was among the probabilities. Mr. King, however, was not lacking in expedients. He had strong hopes of keeping the balloon up until after daylight, and if he failed in this attempt he would tear up the balloon, and, encasing the wicker basket, construct a boat that might float its two passengers down a favoring stream. Meanwhile the balloon was borne along in the storm, at times in the rain which found its way down the sides of the envelope and would have drenched the occupants of the car through and through, but for the protection afforded by an umbrella spread in the hoop above their heads, and again in the clear, cold moonlight above the sea of clouds. At times the balloon probably attained at altitude of nearly three miles, as the cold was intense and there were felt all the effects of great elevation, and at other stages of the journey it was found necessary to keep out a sharp watch ahead for mountain peaks, as a sailor would for breakers, to prevent running ashore. For hours the balloon coursed its way over a wholly unknown region and in an unknown direction, for the compass could not be studied more than the other instruments. The only sounds heard were the ceaseless falling and plashing of the countless forest streams, the pattering of raindrops upon the surface of the balloon, or the reverberations of their voices from some neighboring hillside. The voyagers indulged in the grim humor of holding converse with the imaginary individual below. "Are we in Maine?" they asked. The answer came back with distinctness "in Maine"—which wasn't true, for at that particular time the balloon must have been floating over some portion of the wilds of Canada. In the darkest and most dismal watches of the early morning—probably between three and four o'clock—a new and appalling sound broke upon their ears. It was the solemn, measured breaking of the waves upon the beach. All attempts to make it seem like the murmur of a brook or

the merry music of a mountain cascade failed utterly, and the benighted voyagers realized, after the sound had faded away wholly, and solemn, deathly silence reigned, that they were drifting out to sea in the darkness and fog, with naught to sustain them above the cold waves except a wicker-basket and a gas-bag, whose power must soon be spent. And where were they? Off the coast of Maine probably, but they knew not. And would they fall in with some passing vessel? They might—and then they might not. Especially was the latter horn of the dilemma more likely to be taken if the fog continued. Thus they argued with themselves and with seeming fate. Preparing their minds for the worst, yet abandoning not a whit of their courage or presence of mind, they decided to descend and ascertain the true state of things below them. Mr. King pulled the valve-cord for the first time in the long night, and the balloon slowly descended from its lofty height. Its inmates, as they found themselves surrounded by a dense, damp fog, put themselves in readiness for a momentary plunge beneath the cold waves; but it did not come. The “drag-rope” did its duty splendidly and kept the air-ship some feet above the surface, while it whisked through the water at a terrible rate. This state of anxiety and suspense continued for the better part of a half-hour, when a strange and welcome sight suddenly burst upon the eyes of the watchers. It was a line of trees along the shore, and the misty mantle that overhung the sea seemed rent asunder as it was reached. In a moment more the rope was dragging over the tree tops, and the voyagers were safely delivered from a watery grave. It was thought that the balloon had crossed an arm of the sea to an island or some outstretching cape, and Mr. King deemed it the safest course to keep near the surface of the ground. A brief halt was made under the shelter of a high hill, the drag-rope being suffered to lay its length among the trees, but a freshening breeze endangered a contact with neighboring spire-like firs and spruces, and sand was thrown out to extricate the balloon from the threatened entanglement. As the balloon arose the mournful cadence of the breakers was again heard, but this time Mr. King took good care that he did not pass beyond them. It was now nearly five o’clock, and the increasing morning light enabled the weary travelers to note both the time and their direction. They were floating in a south-west direction, and away from a great expanse of water. They had evidently dropped into a different current, and it was this same lower current which had returned them safely to shore when they had previously found themselves over the water. While there were yet thin, fleecy clouds below them, they descried, partly through the vapory formations and partly beyond them, a straight white line. It was at first believed to be a fence, than a road, and it proved at last to be the

cutting for a projected railway. The balloon was soon brought to a mooring, but there were interminable woods on all sides, and a descent among the tree-tops was unavoidable, unless the æronautic voyagers went farther and fared worse. At the surface, however, there was no great amount of wind, and it was not a very difficult matter to secure the balloon by tying it to the branches of the trees, the passengers finding their way to terra firma down a thirty feet stretch of rope. Once down they set out to find the much-coveted road, and the compass was brought into requisition to enable them to navigate their way out of the woods. Once out and among civilized beings, they were not a little amazed to find that they had been dancing about the borders of the Gulf of St. Lawrence. Their landing place was near the little village of Sayabec, on the line of the contemplated Inter-Colonial Railway, in the lower part of the County of Rimousky, three hundred miles below Quebec. The balloon had been in the air twelve hours and forty-two minutes, and during this time it had traveled nearly six hundred miles. Its course from Plymouth was directly north-east. The most remarkable part of the whole voyage lies in the fact that it was performed by two persons in a small balloon, and with a trifling waste of either gas or ballast. At the end of the journey fully one-half of the two hundred and twenty-five pounds of ballast remained intact, indicating a loss of considerably less of its buoyancy than two thousand cubic feet of hydrogen gas would furnish. Had the voyage been extended, the balloon might possibly have been carried to the shores of Labrador.

VOYAGES OF THE BUFFALO.

In 1873 Mr. King constructed his largest balloon up to that time *The Buffalo*, and made his first ascent in her on the 16th September from Buffalo, in the presence of about 150,000 people. With him ascended four journalists. The balloon had a capacity of 91,000 cubic feet, and its car had seats for nearly twenty persons. After a pleasant voyage, which might have been greatly extended, the balloon was anchored for the night a short distance from Corning, Steuben County, and the following day Mr. King continued his aerial travels as far as Oxford, in Chenango County, a distance of nearly three hundred miles in all.

On September 25th, 1873, Mr. King ascended again from Plymouth, N. H., and passed over the White Mountains, at an altitude of 18,950 feet, or *nearly three miles above the mountain peaks*.

INFLATES THE GRAPHIC BALLOON.

In the fall of 1873. Mr. King was employed by the managers of *The Daily Graphic* to dispatch their transatlantic balloon, which

Messrs. Wise, Donaldson and Steiner, had successively endeavored to inflate, but without success. This balloon, the second largest ever constructed, held over 700,000 cubic feet of gas, and in addition to the passengers, and a most ample store of provisions, clothing and other accessories, carried a sea-worthy boat that weighed upwards of a ton. Mr. King successfully inflated this monster ship, and she was dispatched in a gale of wind blowing due east, on the morning of October 6th, 1873, her passengers consisting of Washington H. Donaldson, the aeronaut in charge, Alfred Ford, *The Graphic* correspondent, and George Ashton Lunt, of Boston, as navigator. The sight was a grand one, as the balloon shot out of the enclosure and rapidly arose. It kept in sight for nearly an hour, finally disappearing at a point nearly due east from the point of departure. The balloon was driven almost as far as the eastern end of Long Island, when under the influence of a contrary current it was carried northward over Connecticut, across a portion of Massachusetts, and finally descended in a severe storm, during which the passengers landed in great peril, at New Canaan, in the north-western part of Connecticut, having covered a distance of nearly 500 miles. *The Graphic* balloon was a remarkable structure as to strength, and was built at heavy expense. Had it been in charge of a more experienced navigator it would undoubtedly have made a much longer voyage. It was by far the largest balloon ever built in America.

On Saturday, July 4th, 1874, Mr. King made his second ascent in *The Buffalo*.

The balloon rose from Buffalo at six P. M. and sailed southeast. It passed over the end of Lake Erie, over Erie and Cattaraugus counties, and then bearing towards the eastward passed over the Maryland line, a line a little west of the Susquehanna river. It continued thence over Newcastle county, Del., Delaware river, just above its mouth, landing in Salem county, New Jersey, at seven A. M. Sunday. The voyage was over five States—Pennsylvania, New York, Maryland, Delaware and New Jersey. The point of landing was 350 miles from the point of departure, but the distance traversed by the balloon was about 400 miles.

Mr. King's next ascension was in *The Buffalo* from Cleveland, Ohio, September 5, 1874. The balloon ascended from the Public Square at 11 o'clock in the forenoon, and at once drifted out over Lake Erie. Rising higher, the voyagers reached another current of air and began drifting towards the centre of the lake, instead of to the northwest, as they had anticipated. There was a fair prospect of reaching Buffalo, and their course was continued for a hundred miles or more, almost contrary to the direction of the lower current of wind. About 3 P. M.

the balloon was lowered into this current, and the voyage was continued to the northwest with the aid of the drag rope, the passengers being a portion of the time not more than fifty feet from the water. The shades of night were gathering as they crossed the Canadian shore near Point aux Pines. This voyage terminated at 11 P. M. in Michigan, about 60 miles north of Detroit. The voyagers were eight hours over Lake Erie, and afterwards crossed Lake St. Clair, making a journey in all of 480 miles.

September 18, 1874, Mr. King made an ascension from Erie, Pa., in *The Cloud Nymph*. After being up two hours and a quarter, swayed backwards and forward by contrary currents, the balloon descended in a field six miles from the city.

October 7, 1874, Mr. King made an ascension from the Fair Grounds at Akron, Ohio, in his balloon, *The Cloud Nymph*. After passing over Cuyahoga Falls he landed near Auburn, Geauga County, Ohio, ten miles from the railroad station.

July 5, 1875, he made his second ascension from Cleveland, in *The Buffalo*, landing at Hebron, Potter Co., Pa.

July 24, 1875, Mr. King made an ascension at St. Louis, Mo., in *The Cloud Nymph*, and on the next day he ascended from the same place in *The Buffalo*.

IN THE MIDST OF THE LIGHTNING.

August 4, 1875, Mr. King ascended in his balloon *Cloud Nymph* from Burlington, Iowa. At the height of 3,000 feet the air ship became enveloped in storm clouds and the lightning flashing in every direction placed the intrepid aeronaut in an extremely dangerous position. The gas in the balloon expanded with such force as to drive it down through the open neck in such quantities as to nearly suffocate the voyager. He opened the valve at the top of the balloon and endeavored to get out of the way of the escaping gas. After being tossed about for twenty minutes, rain began to pour down in torrents and the balloon descended to a dense forest where it went crashing through the tops of the trees. The aeronaut threw his weight on the collapsing cord and the gas escaped, the balloon and net work spreading over the adjoining trees. After a walk of a mile a house was reached and assistance was procured. Mr. King then found that he had alighted two miles south-east from Olena, Henderson County, Illinois. This was one of the most dangerous, and at the same time, interesting voyages ever experienced by him.

October 9, 1875, Mr. King ascended from Erie, Pa., and reached a height of two and a-half miles, passing a mile above the clouds. After skirting the borders of the lake he descended at Union City.

On July 4, 1876, he made an ascension from Boston Common in the presence of upwards of 30,000 people, using his large balloon *Buffalo*, and accompanied by seven persons. The balloon rose to a height of 3,000 feet, and descended upon a farm in Essex county, twenty-two miles from Boston.

On the 4th of August, 1876, at 4.50 P. M., Mr. King made an ascent in *The Buffalo* from the Centennial grounds, Philadelphia, with eight passengers, in the presence of an immense assemblage. The balloon traveled all night, moving to the eastward. At 7 A. M. the party rose to a height of three and a half miles, and the sun could be seen shining upon clouds two miles below. The balloon cast a shadow on the clouds, throwing as it fell a series of concentric rings of rainbow colors. The phenomenon of the aureola was produced in its most gorgeous form; the rings numbering four and sometimes five, and shining with intense brilliancy. At 9 o'clock the voyage terminated at Salt Meadows, Middlesex Co., New Jersey, close to Staten Island.

On August 10th, four days later, a second ascent was made from the Centennial Grounds at 4.50 P.M. The party numbered six passengers. At eight o'clock, P.M., a landing was effected at Marlborough, forty-three miles distant. During a portion of the trip the drag-rope, which touched the ground, caused the balloon to follow the course of the railroad for some miles, simply by its pressure against the telegraph wire. The wind was very gentle, but freshening later, the rope was drawn clear of the telegraph, and the balloon afterwards floated directly with the wind.

February 13, 1877, Mr. King ascended from Memphis, Tenn., in his balloon *King Carnival*, which was built expressly for the occasion. The balloon rose gracefully and floated over the city in a south-westerly direction and gradually disappeared from sight. After going twelve miles Mr. King descended as darkness was approaching at Rossville and returned to Memphis. As his return was not generally known, and the balloon when last seen was proceeding in the direction of the great swamps, fears were entertained for his safety, and several papers published articles predicting that the aeronaut had been lost. In the meantime Mr. King was quietly sleeping at the hotel with his balloon safely housed.

April 3, 1877, Mr. King ascended in *The King Carnival* balloon from Nashville, and landed in Sumner County, Tennessee.

June 18, 1877, he ascended from Nashville, Tenn., at 5 P. M., with Dr. A. C. Ford, of the United States Signal Service, and five others. After reaching an elevation of 6,300 feet, a landing was effected at 7.18 P. M. at Gallatin, 26 miles distant. Here the balloon was

moored for the night. At 8 the next morning three of the party embarked for another trip. At 12.20 P. M. the voyage terminated in a rapid descent from an elevation of 17,000 feet, three miles from Taylorsville.

OVER LOOKOUT MOUNTAIN.

July 4, 1877, Mr. King made an ascension from Chattanooga, reaching a height of one and three-quarter miles. On this trip he crossed Lookout Mountain and Missionary Ridge.

August 30 1877, Mr. King made an ascension from the International Exhibition Grounds, Philadelphia, in *The Buffalo*. The ascent was witnessed by the Governors of nearly all the States and Territories, who were visiting the Exhibition. The balloon landed safely on a farm two miles from Absecon, N. J., about sixty miles from Philadelphia.

On Thursday, September 6, 1877, he made an ascension from Rutland, Vermont, in his balloon *Snowflake*, in the presence of a large assemblage. After ascending nearly two miles and remaining up two hours and a-half above the clouds, *The Snowflake* descended within a short distance from the place whence it arose, affording the same spectators the rare opportunity of witnessing both its ascent and descent.

June 21, 1878, Mr. King ascended from Trenton, N. J., with one companion. After reaching a height of a mile and a half the balloon descended near Hightstown on the line of the Pemberton R. R.

On the morning of October 12, 1878, an ascent was made in *The King Carnival* from Scranton, Pa. He landed two hours later in Montgomery county, having made 125 miles. The wind blew a gale, and the journey was very exciting. A height of 17,000 feet was attained. The descent was rapid and violent, and the balloon was collapsed and ruined by coming in contact with a tall tree. The aeronaut was uninjured.

The foregoing account, necessarily condensed and imperfect, gives but an outline of Mr. King's remarkably successful experience in aeronautics. It will serve, however, to illustrate his coolness, fertility of resources, and the thoroughly practical common sense which on many occasions has secured his safety, and that of many who have accompanied him in his travels through the upper air.

THE REMARKABLE RECORD OF THE BALLOON.

Five centuries ago Roger Bacon laid plans for navigating the air. They were crude and fallible, but they served as a starting point. It was given to the Montgolfier brothers, however, to prove by demonstration that the air was navigable for a ship scientifically constructed. On the 26th of August, 1783, the first balloon rose from the Champ de Mars, under the direction of the Montgolfiers, and, reaching a height of 3,123 feet in two minutes, it entered the clouds to fall, three quarters of an hour later, near the village of Gonesse, fifteen miles distant. This occasion at once opened the field of discussion and experiment.

THE FIRST AERONAUT.

Pilatre de Rozier was the first man to ascend in a balloon. He went up October 15, 1783, from the Faubourg St. Antoine in a hot air balloon forty-eight feet in diameter and seventy-four feet high, and weighing about 1,600 lbs. It was held to the ground by ropes and eighty-four feet was the highest point that it reached. M. de Rozier remained aloft about four and a-half minutes. He made several ascensions on the succeeding days in the same balloon, and on October 21st, he, with the Marquis d'Arlandes, ascended in a hot air balloon and passed over Paris, making a voyage of about five miles in about half an hour.

THE FIRST GAS BALLOON.

On December 1, MM. Charles and Robert ascended from the grounds of the Tuileries in a hydrogen balloon, the first gas balloon ever built, in the presence of 600,000 people. They made a trip of nine leagues in two hours.

THE FIRST AMERICAN BALLOON.

In this country James Wilcox made the first ascension on December 28, 1783, in Philadelphia. On this occasion, instead of one large vessel to contain the buoyant principle, the machine consisted of no less than forty-seven small balloons connected together and attached to the car. Wilcox ascended rapidly, and remained about ten minutes in the air, when, finding himself rapidly approaching the Schuylkill, he made incisions in several of the balloons, and descended to the ground with considerable violence.

The new fashion went everywhere. In 1784, there were fifty-two ascents in France, England, and Italy. From that time to the present

there have been upwards of 5,000 balloon ascents, and very few fatal accidents have happened that cannot be directly traced to ignorance,



THE FIRST AËRIAL VOYAGE.

carelessness, or the use of fire balloons (*i. e.*, those whose ascensive power is furnished by hot air).

OVER THE SEA FROM DOVER TO CALAIS.

January 7, 1785, Blarchard and Dr. Jeffries an American, crossed

the channel from Dover to Calais. At seven minutes past one the balloon left Dover Castle, and in their passage they had a most magnificent view of both shores. When about one-third across they found themselves descending, and were obliged to throw away anchor, ropes, and part of their clothing to keep out of the sea. As they approached the shore the balloon rose, describing a magnificent arch high over the land. They descended in the forest of Guinnes. On this occasion Blanchard experimented with a parachute, his own invention, and let down a dog which landed safely. March 2, 1784, Blanchard made his first ascent from Paris in a balloon of twenty-seven feet diameter. He made in all his career more than thirty aerial voyages.

Madame Blanchard, his wife, who had made many successful ascents, ascended from Paris at night, July 7, 1819, with fire works attached to the car, a spark from one of which ignited the gas and exploded the balloon. She was precipitated to the ground and killed.

DE ROZIER'S FATAL ACCIDENT.

On June 15, 1785, M. Pilatre de Rozier, the first man to ascend in a balloon two years before, attempted to cross the channel from Boulogne to England, in company with M. Romain. Rozier had contrived a double balloon, which he expected would combine the advantages of both kinds—a fire balloon ten feet in diameter, being placed underneath a gas balloon thirty-seven feet in diameter, so that by increasing or diminishing the fire in the former it might be possible to ascend or descend without waste of gas. For rather less than half an hour the aerostat seemed to be going well, when suddenly the whole apparatus was seen in flames, and the unfortunate adventurers came to the ground from the supposed height of 3,000 feet.

THE FIRST PARACHUTE EXPERIMENT.

Garnerin was the first to use a parachute. October 22, 1797, he ascended from Paris in a balloon, and at the height of 2,000 feet cut the cord that connected his parachute with the balloon. The balloon burst, and Garnerin descended in his parachute very rapidly, but landed in safety.

THE CORONATION OF NAPOLEON.

Garnerin had a successful career. He sent up a balloon in honor of the coronation of Napoleon the Great.

At 11 P. M., on the 16th of December, 1804, Garnerin despatched it from the square in front of Notre Dame, Paris. "One sees it rise slowly and majestically" say a chronicler of the times. "Not less than three thousand lights add to its beauty. It is, indeed, a fine sight, but who could then guess the direction it would take, or the sensation

it would cause?" However, on the following morn, at break of day, some of the inhabitants of Rome see at the horizon a brilliant globe coming towards their city. It is soon over St. Peter's and the Vatican; descends, rises again, somewhat torn, keeps near the ground, and falls into Lake Braccaino. Here its pursuers first learn from whence it had come, for on drawing it from the water, they read it in gilt letters on its vast circumference—

"Paris, 25 Frimaire, An XIII, Couronnement de Empereur Napoleon par S. S. Pie VII."

For distance and rapidity this flight would always have been remarkable; but, considering the day on which it took place, it appears almost miraculous. A circumstance in addition, very trifling in itself, became of great importance in the eyes of Napoleon. A political turn, (would any one believe it?) was given to the voyage of the "*ballon perdu*." The balloon, on its course near the ground, left part of its crown on one angle of the tomb of Nero. The Italian papers, not being under such rigorous censure as those of France, innocently related the coincidence: some, however, added malicious remarks injurious to the Emperor. This came at length to the ear of the master, some one even speaking of it at one of his levees. Napoleon showed his displeasure, and ordered that no further remarks should be made about Garnerin's balloon.

The balloon was preserved in a corridor of the Vatican until 1814, with an inscription and date, but all reference to its contact with Nero's tomb was omitted.

Garnerin is said to have made more than fifty ascents. He introduced night ascents, with fireworks, the first of which took place August 4, 1807.

SCIENCE AND BALLOONS.

In 1803 balloons began to be used in the cause of science. The first scientific ascent was made by Robertson and Lhoest, July 17, 1803. They left Hamburg at 9 A. M., ascended to a height of 23,526 feet, and 5½ hours after descended near Hanover, seventy-five miles distant.

Gay Lussac and Biot were among those who experimented in the clouds.

Gay Lussac, in 1804, ascended from Paris, and in six hours traveled 120 miles, having attained a height of 22,966 feet.

ZAMBECCARI.

On March 13, 1785, Count Zambeccari, of Rome, ascended for the first time, from London with Admiral Vernon. Shortly afterwards he returned to Italy, and devoted himself to the practice of aeronautics. He

twice, in 1803 and 1804, descended into the Adriatic, and both times narrowly escaped death. Count Zambeccari suffered the loss of his fingers on the first trip from the effect of the cold. He continued to make ascents to a considerable height. In 1812 he ascended with Bonagna from Bologna in a hot-air balloon. On coming down the balloon caught in some high trees and took fire; to avoid being burned they leaped out, when Zambeccari was killed.

GREEN'S CAREER.

Green was one of the most famous of aeronauts, and in his long career from 1821 to 1857 made nearly 1,400 ascents. He invented the guide-rope. Three times he crossed the sea; twice he fell into it. In 1828 he ascended on the back of a pony, stationed on and fastened to a platform suspended beneath the balloon. He introduced the practice of using coal gas in place of hydrogen. He died in 1870, in his eighty-sixth year, and his accounts are worthy of all confidence.

Green once went 43 miles in 18 minutes in a balloon, ascending from Leeds. He was thrown from his car, and the balloon was afterwards found in Holland. In 1838 he ascended with Rush, an American, who made with him 16 ascents in all, to a height of nearly 4 miles, and four days after they rose to a height of 27,150 feet. Green had several brothers, who made many ascents, and a son named George, who has ascended more than 200 times.

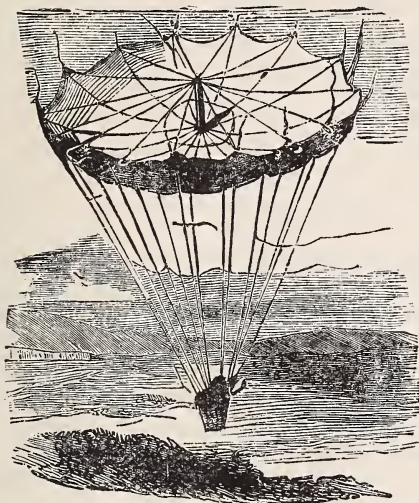
THE FIRST GREAT AIR VOYAGE.

One of the greatest of air voyages was made by Messrs. Green, Monck-Mason and Holland, from London to Weilburg, in the duchy of Nassau, November 7 and 8, 1836, a distance of 500 miles. The balloon was made of silk, pear-shaped, and held 85,000 cubic feet. The ascent was made at half-past one in the afternoon. At twelve minutes to five the balloon reached the line of the sea, and the view of the English coastline exposed to the voyagers was of the most magnificent description. In about an hour they had crossed the Channel, and the light of Calais glittered beneath. The air ship traveled rapidly and smoothly during the night. Soon after dawn the balloon, which had been traveling near the earth, rose to an elevation of about 12,000 feet. The voyagers descended without accident at half-past seven o'clock, about two leagues from the town of Weilburg, having made the journey of 500 miles in eighteen hours.

COCKING'S FATAL DESCENT.

In 1836, Mr. Cocking, an elderly English gentleman of scientific attainments, constructed a parachute of novel form, and to test it ascended with the distinguished aeronaut, Green, from Vauxhall. At an alti-

tude of about 5,000 feet the parachute was detached, and descended to the earth in less than a minute and a half. Cocking was dashed to pieces. The balloon, relieved of its weight, rose to a height of nearly four and a half miles, and the occupants of the car were in great peril, but under Green's skillful management descended in safety.



COCKING'S PARACHUTE.

Jordaki Kuparen'co, a Polish aeronaut, is the only person who ever made any real use of a parachute. He ascended from Warsaw in 1808, in a fire balloon, which took fire at a considerable height; but, being provided with a parachute, he made a safe descent.

OVER THE ALPS.

In 1849 M. Arban sailed from Marseilles over the Alps, and landed near Turin, a distance of 400 miles, in eight hours. He was afterwards drowned in an ascent from Barcelona, Spain.

In 1850 Barral and Bixio made two ascents, the first on June 29, when they reached an altitude of 30,000 feet. July 27, they ascended about 21,000 feet. On both occasions very interesting observations were made.

THE GREATEST AMERICAN BALLOON VOYAGE.

One of the most distinguished of aeronauts was John La Mountain, constructor and manager of the balloon that has made up to this time the second longest aerial voyage. This balloon, called *The Atlantic*, was built of the best Chinese silk, and held about 60,000 feet of gas.

It ascended from St. Louis on July 1, 1859, containing Messrs. John La Mountain, O. A. Gager, William Hyde, of the St. Louis *Republican* and John Wise. The next day it landed at Adams, Jefferson County, New York, having made the distance of 1,180 miles in nineteen hours. The balloon had a common basket car secured to it, and a very light and strong life boat slung below, besides a screw steering apparatus. Mr. Hyde's account of the voyage is substantially as follows: "The writer was a passenger in the air-ship *Atlantic*, which left St. Louis, on the evening of Tuesday, July 1, and landed near the eastern shore of Lake Ontario early in the afternoon of the next day. At a little after six o'clock, Prof. Wise took his place in a large wicker basket, suspended to the 'concentrating hoop' of the balloon, the top of which basket or car was about sixteen feet from the boat. The balloon then being restrained from darting into space by a hundred or more stout hands, was suffered to rise sufficiently to bring the boat in trim, whereupon Mr. La Mountain, Mr. Gager, and the writer stepped in. The aeronauts had very kindly allowed me to accompany them, on condition that if at any time my weight should prove an obstacle to the success of the voyage, I was to be landed—not thrown off as ballast, of course, but brought safely to the ground, and the avoirdupois thus put off, be changed for substances of lesser gravitation—while the others were to go on. The crowd pressed about in such a manner that to adjust the fan wheels of the machinery intended for raising and depressing the ship without the discharge of ballast or gas was found to be impracticable. Thus the good people, anxious to perform any kind office, except to step a little one side, delayed the ascension somewhat, and compelled the aeronauts to relinquish any purpose the wheels might have served, as they could not be arranged in mid-air, without risking life. The cargo consisted of nine hundred pounds of sand, in bags; a large quantity of cold chickens, tongues, potted meats, sandwiches, etc; numerous dark-colored, long-necked vessels, containing champagne, sherry, sparkling Catawba, claret, Madeira, brandy and porter; a plentiful supply of overcoats; shawls, blankets, and fur gloves; a couple or three carpet bags, chuck full of what is expressed in that convertible phrase—a change; a pail of iced lemonade, and a bucket of water; a compass, barometer, thermometer, and chart, bundles of the principal St. Louis newspapers; an express package, directed to New York city; cards of candidates for clerkships in several of the courts; tumblers, cups, knives, and perhaps other articles which have escaped me.

At the word, those who were holding on to the sides of the boat, simultaneously let go, and *The Atlantic* rose slowly and majestically above the many thousands who were gathered in the vicinity, and

sailed off in a direction a little north of northeast. I have seen many large assemblages, but never any to compare in numbers with the throngs who occupied Washington Square, inside and outside the enclosure, who blackened the roofs of houses and the tops of lumber piles, and who filled the streets. The applauding shouts of the people reached our ears for some time after we left the earth, growing fainter and fainter as we receded. When we no longer heard the voices we ceased waving our hats, took seats, and prepared ourselves to enjoy the sublimity of the varied scenery that presented itself for hundreds upon hundreds of miles around; and Mr. La Mountain announced that it was twenty minutes before seven o'clock.

The city of St. Louis was an imposing and magnificent spectacle, showing that, large as I knew her extent of territory to be, it was filled up with most substantial evidence of commercial power and wealth. I have not, from passing through her streets and viewing the mighty arteries throbbing with all the elements of busy life and trade, formed any adequate conception of her real greatness. As it would not be easy to sketch on canvas a correct view of the city as seen from above, similarly difficult must be the undertaking when essayed on paper. From a general appearance of squattiness—the word may not be very elegant, but it is the only one suggesting itself which conveys the idea—objects gradually became less clearly defined. The smoke from the foundries disappeared in the sky; streets grew narrower and darker, until they seemed like thin lines; and finally the city faded into a spot. By this time the barometer had fallen four inches, and the balloon commanded an extended view of the Mississippi, the Missouri and the Illinois rivers. Leaving the noblest of streams to the left, I had an opportunity to realize, as much as possible to a practical person, the meaning of poetic dreams when attempting to portray the silvery glittering sheen of the waters produced by the rays of the declining sun. Nothing could be imagined more gorgeously beautiful. We cracked a bottle of Heidsieck on behalf of the silvery glittering sheen.

The strips of timber land and fields of newly harvested grain of that portion of Illinois over which our silken globe was gliding were not grotesquely mingled as they might be supposed to be when viewed from the distance, but lay like a floor of mosaic masonry, regular and square. To our vision there were no hills nor valleys, every object appearing set upon a level surface. At 7.10 the barometer stood at twenty-four and the thermometer indicated fifty-five degrees. I had now the singular sensation about the ears which has been described as the experience of all aeronauts on their first voyage. It was unpleasant and annoying, but by no means painful; very much such a feeling as one has when, while bathing, these organs become stopped up with

water, making the tympanum grate rather harshly at any sound. The monster vessel had expanded a good deal since the ascension and had acquired a more round and symmetrical appearance than that exhibited upon starting.

In a few minutes gas was blown off from the tube at the mouth of the balloon, the signal that it had become inflated to its fullest capacity. Prof. Wise, who had charge of the rope connecting with the valve at the top, promptly gave it a pull, and immediately thereafter a quantity of bluish vapor floated off and circled upwards. This was at fifteen minutes after seven o'clock. A quarter of an hour later the air-ship had descended very considerably; the barometer indicated twenty-seven inches and the thermometer sixty-five degrees. All this time the happy quartette had been conversing about the magnificent scenery, relating anecdotes and watching with interest the progress of Mr. Brooks' balloon, *The Comet*, which had preceded us from Washington Square.

A MAGNIFICENT SENSATION.

Every vestige of St. Louis had now vanished from our sight, and we were drifting at a wonderful rate of speed toward our far-off destination. I do not think I ever experienced such exhilaration of spirit, such real joy. Our motion was perfectly steady. There was no rocking of the boat or car, no rustling of the silk; nothing, indeed, but the receding forests and fields beneath to tell us we were not poised between earth and sky in a dead calm. To have been apprehensive of danger would have been next to impossible; to have felt fear would have been not cowardice but pusillanimity. My feeling was that ballooning, besides being the most pleasant and swift, was the safest mode of travel known.

Steaming down a rapid current in a boat on a lovely evening, with sublime bluffs, romantic avenues, and green foliage on either side, glistening waves below and a mild sky above, is grand and delightful; sailing on an unruffled lake, parting the placid waters and skimming like a gull with gentle fleetness is ineffably glorious. But these enjoyable methods of travel I felt yielded in point of dainty pleasurable-ness to the bud-like grace and impressive surroundings of aerial navigation. With us no breath of breeze was stirring. The buoyant down of a thistle released from the willow car would have fallen to the boat by its own specific gravity. In all its calmness our monster bubble floated through the clouds. Twilight was on the earth and gave to the color of the soil the appearance of frozen lakes. By this time the sun had set to the inhabitants of the earth, though to us it was four or five degrees above the horizon. And thirty-two minutes after 7 we saw

our escort, *The Comet*, which looked like a mere bladder, effecting a landing far to the northeast.

At thirty-six minutes after 7 o'clock we were favored with a view of sunset such as no painter could depict nor any enthusiast describe. We were passing over the magnificent prairies of Illinois—those oceans of agricultural wealth—St. Louis lying south, half west, behind us, and the brightness of the western sky was in fine contrast with the oncoming darkness of the Mississippi and tributary streams.

Above it has been mentioned that at half-past 7 o'clock, the barometer indicated 27 inches. It may be necessary to refresh the reader's recollection here by stating that the use of the barometer is to measure the different degrees of atmospheric weight of pressure by the rise and fall of mercury in a tube. The pressure of the air varies as we ascend from the earth, the medium altitude of the mercury at the surface being from twenty-nine to thirty inches. The diminution of the density of the atmosphere is perceptible on a lofty hill, and is proportionably greater, of course, at more decided heights.

At ten minutes past 7 o'clock the finger of the barometer had pointed to 24, showing an altitude of one mile. Thus it will be observed that in twenty minutes we had descended rapidly to the earth, and explanation is apparent that this depression was the result of the discharge of gas, the buoyant power. To atone for the descent it was in turn requisite to throw off ballast and lessen the weight which the balloon had to carry, which was done by opening a bag of sand and dropping a few handfulls. At 8 o'clock, the mercury in the barometrical tube told 26 inches, and five minutes subsequently $23\frac{1}{2}$, which showed that our gallant ship lifted herself wonderfully.

The rising of the fluid was not the only way by which we knew we had been attaining a greater altitude, for we now enjoyed the rather unusual occurrence of beholding the sun rise in the West—apparently rise, for the glorious luminary had only disappeared as our craft sank and again came in sight as the mysterious influence of the sand-bag lessened the distance between us and the earth. A quarter of an hour elapsed and it became dark. The barometer then stood at 23 and the weather was bitter cold. Our shawls and our coats and gloves came into requisition, but in spite of these artificial aids to comfort, our limbs were numb and our teeth chattered after the manner of an American bottom ague. It was, I think, about this time an incident occurred both exciting and alarming.

A PERILOUS SITUATION.

Prof. Wise crouched himself down in the wicker-car, covered his

body with shawls and other articles of warmth, and was paying his devoirs to the drowsy god of sleep. The balloon had again become inflated to its fullest tension, and Prof. Wise lay immediately under its mouth. Mr. Gager had to address some remark to him, but received no answer. It was deemed impossible that he had fallen asleep so soon, and Mr. G. again accosted him, this time in a louder tone. Still there was no response. A third and fourth time did he call, but heavy, deep and convulsive breathings were the only result. Mr. Gager, almost pale with apprehension lest something fearful had occurred to Prof. Wise, at once bounded to one of the upright irons of the fan wheel machinery, and with assistance from one of his fellow voyagers, clambered into the car. It was a lucky circumstance for Prof. Wise that he did, for Mr. Gager found that the tube at the mouth of the balloon was directly under the former's nose, and that the expansion of the gas had driven some of the hydrogen directly into his face. He was at that time insensible, though as soon as the tube had been removed by Mr. Gager from its proximity to the Professor's olfactories, and a few hearty shakes given him, the comatose man revived, rubbed his eyes, muttered a few incoherent syllables, and inquired what brought his friend into the car, and what was the matter.

THE CURRENT TO THE EAST.

While this was going on *The Atlantic* had found the current that the aeronauts had declared was always blowing in the upper regions, from the occident to the orient, and was now traveling toward the very star which they had picked out in the firmament as the beacon of the course they wished to take. The discovery was one well calculated to perfect the restoration of senses in Prof. Wise, so happily begun by Mr. Gager.

There broke from his lips a little cough, and saying, "Boys, let's sing," he struck up the stirring national anthem, Hail Columbia, in which we all joined and carried through with a great deal of vigor and very little time, as the frigidity of the atmosphere put quite a damper on patriotism and melody.

We kept along on the west-east current only a little while, however, as from experiments made, it is important to say here at the sacrifice of both gas and sand, it seemed that the lower currents were blowing nearly east (it turned out that their course was a good deal north of east), and it was determined that the increase of our comfort would more than compensate for the loss of time in making the coast by lowering the vessel a considerable distance. It was some time before it was ascertained what amount of the ascending power it would be necessary to discharge in order to depress the balloon to the proper point,



and not until quite a large quantity of ballast had been expended, it being no longer light enough to make any instrumental observations.

The aerial ship descended until the atmosphere ceased to be very cold, when our party began a siege on the eatables and drinkables, dispatching various good things—solid, fluid, and mixed, with alacrity and relish.

A NIGHT VIEW FROM THE BALLOON.

About this time (a little after midnight) there were momentary flashes of lightning on all sides of the horizon. The milky way appeared like luminous phosphorescent clouds, and Heaven's jeweled tiara of stars glistened below us and above us. Night's queenly brow shimmered with the mellow light of the newborn crescent moon. Starlight and moonlight! Here was the poesy to which Shelley paid such deep adoration, and which Alexander Smith delighted to cherish and to cultivate.

Here was the mighty scroll of the cerulean-pillared firmament, glittering all over with gorgeous heraldry. We broke another bottle to the blue sky glittering all over with its gorgeous heraldry.

At 12.35 we passed over a small river, but were unable to tell what it was, not being able to trace its course for a sufficient distance. At 1 o'clock we found ourselves sailing over a dense forest, and, being then quite low, distinctly heard the wind passing through the tree boughs, sounding like a heavy rain. We emerged from the woods, if the term is allowable, and floated over several habitations, which we saluted with our united voices.

Only the dogs and the bull frogs had the kindness to send up their uncivilized acclamations, and in return we dispatched them the latest intelligence from St. Louis, done up in a copy of the *Evening News*, as affording a sort of compromise between our language and theirs. At 1.30 we glided over another river, and as we thought a canal, and thirty minutes later over a railroad track. The river was doubtless the Wabash and the railroad the New Albany and Salem. Prof. Wise and Mr. Gager had been asleep since about 12.30 and appeared to give the matter their unremitting attention. I had taken about an hour's rest in broken doses; having been in a dilemma whether to close my eyes on sublunary things or to keep a visual open for passing events. The quandary was settled by my coming to the conclusion that as such trips as *The Atlantic* was making were by no means of every day occurrence, it would not do to miss any of the incidents.

Mr. La Mountain, who had been very jovially inclined during the early part of the night, suddenly became rather indisposed to talk, and I observed him bowing with closed eyes at the bottom of the boat. He had worked with great industry at Verandah Hall in getting the

cords, valves, etc. in trim for the voyage, and had taken but little time to sleep. Morpheus seemed to have some claim upon him and was disposed to press it. While Mr. L. was dozing I observed a current of air was taking us downwards, and called his attention to it. We had just time to scoop up a couple of handfuls of ballast apiece and drop them overboard to save us from a collision with a clump of trees, which stood in alarming proximity. Such was our nearness to the earth at this time that we very distinctly heard the sand fall on the ground.

The balloon, once more freed from a portion of her freight, darted up again into the air, and went above the branches without touching, though the margin was quite small. It was 2.40 then. The goddess of the dawn was just leading her coursers of daylight to the gate of the horizon, tinging the east with a faint purple glow. Pretty soon another ruddy flame lighted up, and at 3 o'clock I could distinguish where there was a line in my note book sufficiently to avoid making one memorandum directly over another. Five minutes elapsed, and the stars have gone off their beats, and the deep-mouthed dogs are going to their kennels.

The balloon was now riding majestically through the clear ether. We were not high, apparently, yet a house below us looked the size of a cobble stone. Messrs. Wise, Gager and La Mountain were fast asleep, and it devolved on me to be "scientific director, navigator, and aeronaut," in one—the responsibility of which, I flatter myself, was not misplaced, inasmuch as there could have been nothing more for me to do except to wonder how far we had traveled, what course we were taking, where we were going, and when we would get there—duties that I performed with astonishing proficiency, for a novice.

Yet I was not so engrossed in this philosophical employment that I could not observe passing events. I noticed the same combination of forests and fields, with regular squares, that had attracted my attention in the early part of the evening whilst above Illinois, but the balloon was nearer the earth now, and every object was dressed in an emerald hue. A piece of ice, weighing about three pounds, which had been placed in the water-bucket at starting, had melted to the size of a walnut, from which circumstance it will be inferred that the weather had not been intensely cold.

At 3.25 we floated over a village composed of a dozen or so of houses in a pretty cluster. By this time all the party were awake and lively, and we chatted, and sang, and ate till sunrise, at 4.15, when we left to the right of us a large town which Mr. La Mountain said was Fort Wayne, Ind. We could plainly hear the shouts of the astonished and delighted inhabitants, and Mr. Gager led off with a resounding and jolly hurrah, given by the whole of us with a will. We ac-

cordingly lost much breath for nothing, for it is not probable we were heard. If there was but one crooked river in the world, no person going over the Wabash, attached to a balloon, would hesitate to say that was it. Prof. Wise jocularly remarked that fishes would have tiresome work navigating that stream. Mr. Gager thought it would afford excellent opportunities for the display of science on the part of a steersman of a flat boat. Mr. La Mountain asserted that the steersman might imagine it a grand stream for dams, while I could only make a remark, not very funny, that the Wabash, like a tired toper, did not pursue its course on undeviating principles, the idea of which I stole from Hood.

At twenty-seven minutes past 4 o'clock we were sailing at a moderate speed near the forest, in a northern course, the thermometer ranging at 74 degrees, and the barometer as low as $37\frac{1}{2}$ inches. Although the aeronauts were not pleased with the state of things, they said it was not best to throw off any ballast, as the sun's rays on the balloon would heat the gas and give the vessel a new impetus upward. There was good philosophy in that, and pretty soon we noticed its verification. At fifteen minutes after 5 o'clock the mercury in the barometer showed our altitude to be nearly one mile. We could then hear the lowing of the cows with distinctness. In seven minutes more the barometer indicated $23\frac{1}{2}$ inches, or as near as could be approximated, only three inches and a-half below the minimum figure reached during the voyage, which was at night, when it was too dark to make observation on the instrument. Our highest altitude, therefore, was about two miles.

"THE LAKE! THE LAKE!"

Twelve minutes after 5 o'clock we descried in the east what at first appeared to be the reflection of the sun on the sky. At last one of the party asserted that we were not many miles from a lake; and so it was, as the reader shall know by and by. The noble air-vessel was rushing along at a brisk rate, dragging its shadow on the ground encircled in fantastic colors. There was no doubt that what had at first seemed a brilliancy of the eastern heavens was nothing less than an immense body of water.

The aeronauts concluded that it could only be Lake Erie, and they were right, for, tracing the shore, and observing the little islands, its contour corresponded almost precisely with the map.

A SUBLIMER SCENE

now broke on human view. Lake Erie, it will be remembered, has a surface of 7,800 square miles, and although we could not behold the

whole of it, the view lost none of its magnificence from this cause. Its expanse, limited and bounded by the great zone where it blended with the heavens, seemed an eternity of waters, vast, measureless as the bending canopy itself.

Groups of white clouds, like great puffs from a steam-pipe, floated languidly on every side, unfolding their gauze-like robes, and passing off in eddying currents. There was a collection of houses huddled together, where the Maumee river pours its tribute into the lap of the lake, and this was Toledo; and there, in that great bend, dotted with specks of land, Perry gained his victory, in 1813. 7 o'clock saw the gallant *Atlantic* parting company with the shore a little north of Port Clinton, then making due east. We were low enough to distinguish objects of the size of men, and as the balloon darted above houses, we could plainly discern people, and hear their voices. One apprehensive individual bellowed out, "You'd better watch out; that's the lake;" while another contented himself with the exclamation, "Hooe-e!" A small propeller did *The Atlantic* the honor to blow her whistle as a salutation, and immediately hove to, her commander, doubtless, imagining we were about to descend into the water, when he would have to pick us out. A considerable quantity of ballast was now discharged, and as at 7.25 we swept by Sandusky city, the barometer shot up to 23½ inches, the thermometer indicating 50 degrees.

The balloon having reached the rarified regions, expanded almost to her full capacity, and again it was found necessary to pull down the safety-valve and let off gas. By this time we had sailed far from the shore, and the bosom of the lake appeared dotted for miles with white objects, which we knew to be schooners.

Messrs. La Mountain and Gager had been asleep since 7 o'clock, but at 8.30 Prof. Wise directed more ballast to be thrown overboard, and they awoke to see what the matter was. The alarm which suggested this was soon over, however, and at 9 o'clock the whole party were as merry as when they were lifted toward the clouds at starting.

EIGHTY MILES AN HOUR.

At half-past 9 o'clock we overtook a steamer bound for Buffalo, the decks of which were crowded with persons, whose huzzas were borne to our ears, attended by the shrill scream of the boat's whistle. We were wafting along not more than 500 feet from the Lake, in a northeasterly course, making decidedly the fastest time on record. At six minutes of 10 o'clock the steamer could be faintly seen on the horizon, so rapid was our flight. The balloon was then passing over Long Point, near the spot made famous by the delectable prize-flight of Morrissey and Heenan. Soon we had traversed nearly the entire

length of Lake Erie, a distance of 250 miles, accomplishing it in three hours.

ERIE AND ONTARIO.

At 10.30 o'clock we had lakes Erie and Ontario both in sight, a spectacle that could not be viewed without a mingled sentiment of admiration and wonder. The balloon had soon attained an altitude of nearly a mile. A terrible storm was surging beneath us, the trees waving and the mad waves dashing against the shore of Erie in an awfully tempestuous manner. But above the careering whirlpools and the thundering breakers swam the proud *Atlantic*, not a cord displaced nor a breadth of silk disturbed, and gaily heading for the salt crests which bound our vast Republic. Now, like a gurgle, comes the subdued sounds of the plashing and headlong cataract of Niagara.

OVER NIAGARA.

At 11 o'clock, having skimmed over the Lake shore, still bound eastwardly, the balloon brought us in sight of Buffalo and Niagara Falls, as also the Welland Canal. We had reached a height of more than a mile, the barometer marking 23.6 inches.

At 12.30 we were nearly between the Falls and Buffalo, inclining rather to the left of the latter. Here we had a view of the great cataract O-ni-au-ger-rah ("the thunder of the water") as the Indians call it, General Brock's monument, Queenstown, Grand Island, St. Catherine's, Green Bay, Lewiston, Black Rock, Fort Erie, and other celebrities of that locality. The famous falls were quite insignificant, seen from our altitude. There was to us a descent of about two feet, and the water seemed to be perfectly motionless. The spray gave the whole an appearance as of ice, and there was nothing grand or sublime about it. Passing the western terminus of the Erie Canal, the balloon was borne directly toward Lake Ontario. Our ballast was now nearly exhausted, and to have determined on crossing the second lake would have been sheer recklessness and hardihood. Here it was debated whether it were better to land Mr. Gager and myself, and in our stead take in a sufficient quantity of new ballast, and again steer for the Atlantic Ocean. Could this have been done there is scarcely a doubt of Messrs. Wise and La Mountain reaching their destination.

IN THE HURRICANE.

The air-ship was lowered, but was immediately caught in the hurricane which was then raging, and carried very near the tops of trees which were bending and swaying to and fro by the force of the wind. Mr. La Mountain at once threw over the buckets and their contents, and the lift this gave us kept us from being crushed in the woods.

Like a bullet, we shot out into the lake. The machinery was got in

readiness to be tossed out, and every possible preparation made for keeping out of the waves. For a while we cherished the hope that we would be able to pass the broad expanse of deep in safety, though we knew we had nearly 190 miles to traverse. But this hope died out in less than an hour, as the trooping winds bore down on us, it seemed, with greater and increased fierceness. We had got far out, and there was no land in sight. A dreary waste of 7,000 square miles of water was before and around us.

SINKING.

At length we neared the dashing billows, which were wildly flinging up their white caps and chasing one another toward the northeast. For me a lifetime was concentrated in that awful, perilous moment. It was the first time since I had set foot in the boat suspended to the balloon that I had experienced fear as to my safety. I looked around at my companions; they were calm, but their countenances gave me no assurance. Plunge, plunge, went the iron bars of the machinery into the waves, now rolling ten feet in height. And *The Atlantic*, obedient to this meagre control, again bounded upwards out of the way of the dark and hungry element. There was great relief in this, but the coolest reason could not have seen in the circumstance anything but momentary encouragement. I cannot recollect whether it was at this point, or before, that Mr. Gager climbed up into the car with Prof. Wise. Whenever it was, he did so as much for the security of the entire party as for his own safety, for there is no selfishness in Mr. Gager, see him where you will.

For a time again our flying ship was buoyed up out of the way of hazard, but would frequently dart downwards, as though intent on burying us all. This movement was promptly checked by throwing out some article as ballast; and thus carpet-sacks, containing clothing, overcoats, bundles of papers, provisions, were pitched out into the lake, and still we kept in almost hopeless proximity. Mr. La Mountain said he desired to take care of the boat, and advised me to get into the car above with Messrs. Wise and Gager, which I hastened to do. No sooner had I planted myself firmly in the wicker basket than down, down, down with fearful speed went the balloon towards the lake. I closed my eyes involuntarily, but was quickly aroused by a crash and a lunge of the car forward. Three times was there a terrible clatter and splash.

A BRAVE MAN.

"One moment more of life!" thought I. Looking around I beheld a hat floating off, and the same instant the balloon darted out of the water, "Poor La Mountain!" was in my heart to say, for I thought him gone; but a cheerful "All right, boys!" stopped me and lightened me of my

grief." Now came a test of La Mountain's bravery, and nobly did he stand it. Taking a hatchet from the car, where it was swung, he began loosening the planks making the lining of the boat, which he sent overboard at every indication of another descent. When he had gone as far as possible this way, he unscrewed the nuts which had been placed in the side of the boat, by which to fasten the machinery.

Gathering all articles of no matter how little weight together, he sent them with the rest, the oars went over next, and at last there was nothing in the boat. He had taken off his coat to it, and worked till the perspiration ran from his brow like rain, and all the while speaking hopefully and endeavoring to quiet our apprehensions. When there was nothing more to be done below, Mr. La Mountain drew himself up by the rope of the car. Everything had now gone but an overcoat and two blankets, which were saved to be used as a final resort.

How wistfully did four persons strain their eyes that day in the direction of the shore, and would it never, never come in sight? Mr. Gager's face bore an expression of mingled sadness and solicitude; perhaps he was thinking of a group of happy faces, all unconscious of his peril, away in Bennington, Vermont. Mr. La Mountain seemed more hopeful, and Prof. Wise talked as though he was certain of getting safe over the lake, though he warned us of danger as soon as we should be off the water.

LAND AHEAD.

Wise's theory was that, if the boat should get swamped, the balloon would still have momentum and power sufficient to drag us to shore, which, happily, had by this time appeared in the dim distance. A propeller called "Young America," shortly afterwards bore down upon us to come to our relief, but we scudded some hundreds of feet before her bows, and so that hope failed.

THE PERIL OF THE LAND.

Finally, after skirmishing within thirty feet of the dark waves, for a distance of not less than fifty miles, and perhaps more, we had the joy to know that we were out of danger of drowning; but a new peril was before us. Professor Wise had been quite right in his prediction. The hurricane blew us immediately into a dense forest which skirted the lake, and threatened to tear us limb from limb.

Mr. Gager had thrown out the anchor, a heavy iron one, with three hooks, each an inch and a quarter in thickness. So rapid was our flight, that this stood out nearly straight from the car. As the grapnel swung against the trees of moderate size, the velocity of the balloon and its terrible strength would tear it down, and fling it to the ground. One by one the hooks broke off, and we were again at the mercy of an

all-sweeping wind. Mr. La Mountain and I held on to the valve rope, endeavoring to discharge the gas, but we were quickly compelled to release our grasp, and cling to the concentrating hoop to avoid being thrown out.

The meshes enveloping the silk of *The Atlantic* had an aggregate strength of one hundred tons. It is strange that it was some time before the strong cords were broken.

CRASHING THROUGH THE FOREST.

The balloon actually went through a mile of forest, and tearing down trees and breaking branches, pursued its resistless course, dashing our party in the willow car to and fro, against trunks and limbs until the stout netting had broken, little by little, and the balloon itself had no longer any protection, when striking a tall tree, the silk was punctured in a dozen places, and rent into ribbons, leaving the car suspended by the netting twenty feet above the ground. The course of the balloon through the woods, left a path similar to that of a tornado. Trees half the size of a man's body, were snapped in twain as though they were pipe-stems, and huge limbs were scattered like leaves.

SAFE AT LAST.

It is difficult to see how any of the quartette escaped with his life. It happened that the landing was made within 150 yards of a settlement, and the crash was so great that the people ran to the spot to see what had happened. Singular as it would appear, there was only one of the four injured in the least, Mr. La Mountain receiving some slight contusions about one of his hips, but the remainder escaped without a scratch. When we got down, which was done partly by ropes and partly by means of a broken tree, several persons were standing around with open mouths and eyes staring out wonder. We then learned that we had landed on the place of Truman O. Whitney, near Sackett's Harbor in the township of Henderson, Jefferson County, N. Y. By Mr. La Mountain's watch, the time was two o'clock and twenty minutes.

TWELVE HUNDRED MILES IN TWENTY HOURS.

We had been nineteen hours and forty minutes traveling a distance which cannot be computed at less than 900 miles, and is said to reach as much as 1200.

ANOTHER PERILOUS VOYAGE.

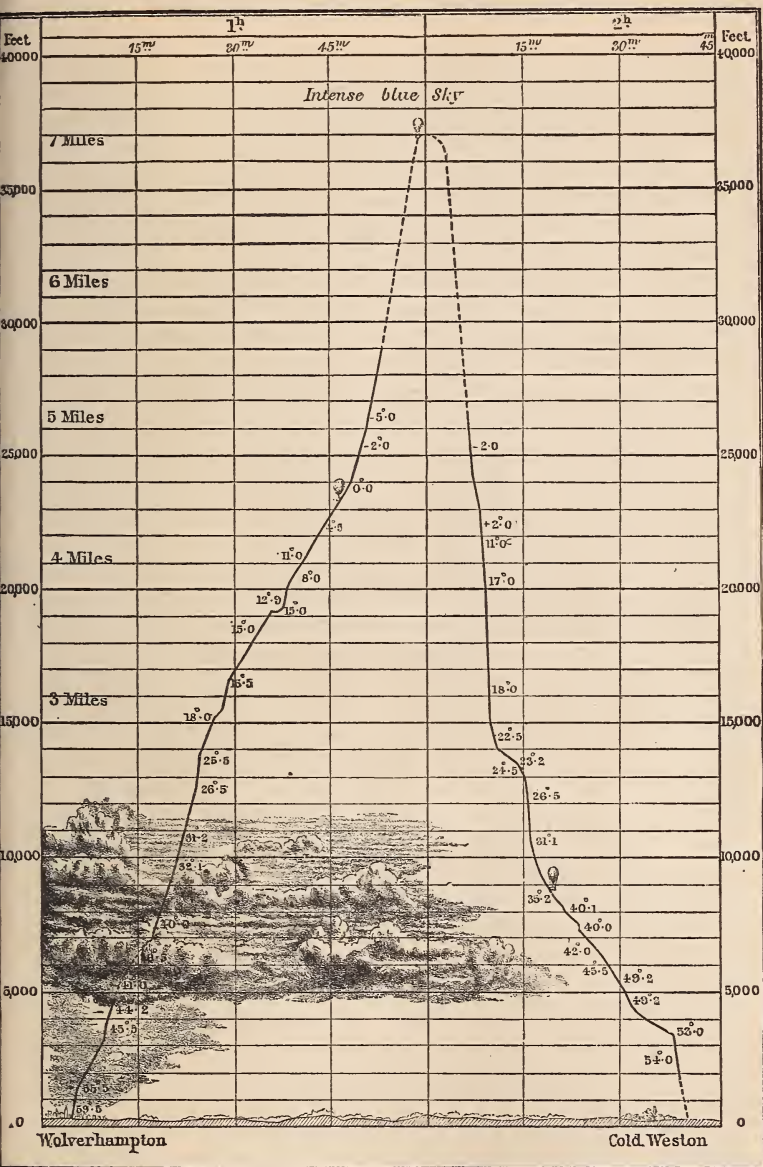
On September 22 succeeding, Mr. La Mountain, accompanied by Mr. J. A. Haddock, of Troy, N. Y., ascended in the same balloon—*The Atlantic*—from Watertown, N. Y. They rose about 5.30 P. M. and drifted northward, reaching a height of three and one-

half miles during the night, in the darkness of which they descended. In the morning they found themselves in the midst of dense woods. After wandering for four days without food, they discovered a Scotch guide, a member of a lumber party, 150 miles due north of Ottawa. They finally arrived home after having nearly starved to death and suffered every privation. The balloon was abandoned in the woods.

THE HIGHEST ALTITUDE YET REACHED.

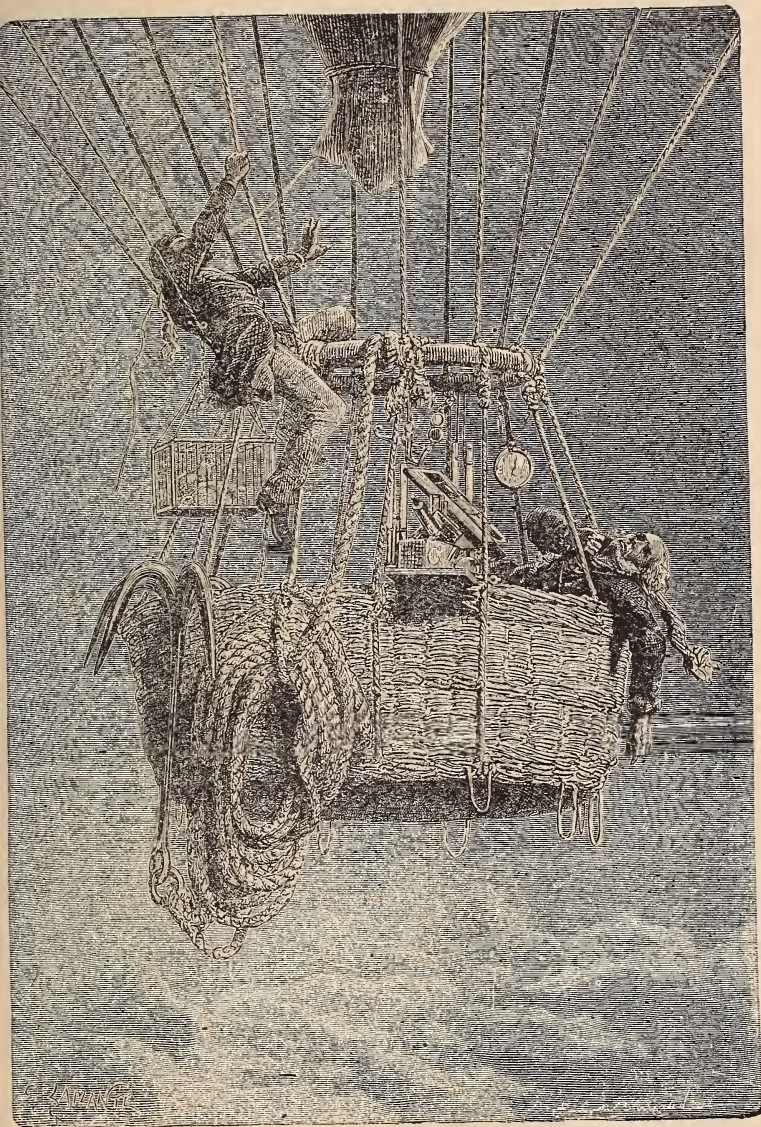
Mr. James Glaisher, of England, has attained eminence as a scientific aeronaut, and his work *Travels in the Air* is one of the most interesting on the subject. His first ascent was made in 1862. On September 5, 1862, he made a very noteworthy ascent with Mr. Coxwell, the aeronaut, attaining probably the highest altitude ever reached in a balloon. The balloon had a capacity of 90,000 cubic feet, and was made of American sheeting. It was about one-third full, and ascended with 600 pounds of ballast. They left the earth at 1.30 P. M., with a temperature of 59 degrees at starting. In thirty-seven minutes a height of four miles had been reached. From this point we give the narrative in Mr. Glaisher's own words :

"The temperature was 8 degrees. Discharging sand, we in ten minutes attained the altitude of five miles, and the thermometer read 2 degrees. Up to this time I had taken observations with comfort, and experienced no difficulty in breathing, while Mr. Coxwell, in consequence of the exertion he had to make, had breathed with difficulty for some time. Having discharged sand we ascended still higher ; the aspirator became difficult to work, and I also found difficulty in seeing clearly. At 1 h. 51 min. the barometer read 10.8 inches. About 1 h. 52 min., or later, I read the dry bulb thermometer as minus 5 degrees ; after this I could not see the column in the wet bulb thermometer, nor the hands of the watch, nor the fine divisions on any instrument. I asked Mr. Coxwell to help me read the instrument. In consequence, however, of the rotatory motion of the balloon, which had continued without ceasing since leaving the earth, the valve-line had become entangled, and he had to leave the car and mount the ring to re-adjust it. I then looked at the barometer and found its reading to be $9\frac{3}{4}$ inches, still decreasing fast, implying a height exceeding 29,000 feet. Shortly after, I laid my arm on the table, possessed of its full vigor, but on being desirous of using it I found it powerless, it must have lost its power momentarily ; trying to move the other arm I found it powerless also. Then I tried to shake myself and succeeded, but I seemed to have no limbs. In looking at the barometer my head fell over my left shoulder. I struggled and shook my body again, but could not move my arms. Getting my head upright for an instant only, it fell over my right



PATH OF THE BALLOON IN ITS ASCENT FROM WOLVERHAMPTON TO COLD WESTON, NEAR LUDLOW,
 SEPTEMBER 5, 1862.
 ROUTE OF THE BALLOON IN MR. GLAISHER'S GREAT ASCENT.

shoulder ; then I fell backwards, my back resting against the side of the car and my head on its edge. In this position my eyes were directed to Mr. Coxwell in the ring. I dimly saw him and endeavored to speak, but could not. In an instant intense darkness overcame me, so that the optic nerve lost power suddenly, but I was still conscious, with as active a brain as at the present moment whilst writing this. I thought I had been seized with asphyxia, and believed I should experience nothing more, as death would come unless we speedily descended. Other thoughts were entering my mind, when I suddenly become unconscious as on going to sleep. I cannot tell anything of the sense of hearing, as no sound reaches the ear to break the perfect stillness and silence of the regions between six and seven miles above the earth. My last observation was made at 1 h. and 54 min. above 29,000 feet. Suppose two or three minutes to have elapsed between my eye becoming insensible to seeing fine divisions and 1 h. 54 min., and then two or three minutes more to have passed till I was insensible, which I think, therefore, took place about 1 h. 56 min. Whilst powerless, I heard the words "temperature" and "observation," and I knew Mr. Coxwell was in the car speaking to, and endeavoring to rouse, me—therefore consciousness and hearing had returned. I then heard him speak more emphatically, but could not see, speak, or move. I heard him again say : "Do try ; now do." Then the instruments became dimly visible, then Mr. Coxwell, and very shortly I saw clearly. Next I arose on my seat and looked as though waking from sleep, though not refreshed, and said to Mr. Coxwell, "I have been insensible." He said, "You have, and I too, very nearly." I then drew up my legs, which had been extended, and took a pencil in my hand to begin observations. Mr. Coxwell told me that he had lost the use of his hands, which were black, and I poured brandy over them. I resumed my observations at 2 h. 7 min., recording the barometer at 11.53 inches, and temperature minus 2 degs. It is probable that three or four minutes passed from the time of my hearing the words "temperature" and "observation" till I began to observe ; if so, this gives 7 minutes for total insensibility. I found the water in the vessel supplying the wet-bulb thermometer one solid mass of ice, though I had by frequent disturbances kept it from freezing. It did not all melt until we had been on the ground some time. Mr. Coxwell told me that while in the ring he felt it piercingly cold, that hoar frost was all round the neck of the balloon, and that on attempting to leave the ring he found his hands frozen. He had, therefore, to place his arms on the ring and drop down. When he saw me he thought for a moment that I had lain back to rest myself, and he spoke to me without eliciting a reply ; he then noticed that my legs projected, and my arms hung down by my side, and saw that my countenance was serene and placid, without the



MR. GLAISHER INSENSIBLE AT THE HEIGHT OF SEVEN MILES.

earnestness and anxiety he had observed before going into the ring ; then it struck him that I was insensible. He wished to approach me, but could not ; and when he felt insensibility coming over him too, he became anxious to open the valve. But in consequence of having lost the use of his hands he could not do this ; ultimately he succeeded by seizing the cord with his teeth, and dipping his head two or three times until the balloon took a decided turn downward.

No inconvenience followed my insensibility ; and when we dropped, it was in a country where no conveyance could be obtained and I had to walk between seven and eight miles.

During the descent, which was at first very rapid, the wind was easterly. To check the rapidity of the descent, sand was thrown at 2.30. The wet bulb seemed to be free from ice at this time, but I held the bulb between my thumb and finger, for the purpose of melting any ice remaining on it or the connecting thread. The final descent took place at Cold Weston, seven miles and a half from Ludlow. All the observations lead to the inevitable conclusion that a height of fully seven miles was attained. In this ascent six pigeons were taken up. One was thrown out at a height of three miles, when it extended its wings and dropped like a piece of paper ; the second, at four miles, flew vigorously round and round, taking a dip each time ; a third, thrown out at four miles, fell like a piece of stone. A fourth, thrown out at four miles, on descending, flew in a circle and alighted on the top of the balloon."

Mr. Glaisher has made in all twenty-eight ascents.

COXWELL.

Mr. Henry Coxwell of England, who has made several hundred ascensions, began in 1844, under the name of Wells. Mr. Glaisher made most of his ascensions with Coxwell.

In 1847 Mr. Coxwell ascended with three others, about 11 o'clock at night from London, with a discharge of fireworks from below the car. When 6,000 feet high the ballon burst. The neck of the balloon was tied to the hoop above the car. Coxwell was standing on the hoop. He cut the string which held down the neck, the latter was jerked violently up to the crown of the balloon, a parachute was formed, and they descended safely. In the descent the balloon was covered with sparks from the fireworks, threatening every moment to blow up.

LE GEANT.

In 1863, M. Nadar, an ingenious French photographer, constructed *Le Geant*. It held over 200,000 cubic feet.

Underneath it was placed a smaller balloon, called a compensator,

the object of which was to prevent loss of gas during the voyage. The car had two stories, and was in fact a model of a cottage in wicker work, eight feet high, and thirteen feet in length, containing a small printing office, a photographic department, refreshment room, &c. The first ascent was made at 5 o'clock, P. M., October 4, 1863, and thirteen persons went up. At 9 o'clock the balloon descended at Meaux, an accident to the valve line having occurred. A second ascent was made a fortnight later with nine passengers. After a voyage of seventeen hours the balloon descended near Nienburg in Hanover, a distance of about 400 miles. A strong wind was blowing, and the balloon dragged over the ground a distance of seven or eight miles. The balloon was afterwards taken to England and exhibited at the Crystal Palace.

THURSTON'S DEATH.

September 16, 1858, Ira Thurston and a Mr. Bannister made an ascension from Adrian, Michigan, at 9 o'clock in the morning. After a journey of forty minutes they descended about eighteen miles west of Toledo. They proceeded to empty the balloon. In doing so, Mr. Thurston took off his coat and got astride of the valve block. He suggested that the car be detached from the balloon, while he should hold it down with his weight. No sooner was this done than the still inflated body shot into the air with the suddenness of a rocket, taking Mr. Thurston along with it. In this perfectly helpless condition the ill-fated man sped straight into the sky. The part of the balloon filled with gas was fully twelve feet above him, and there was no way by which he could reach it and relieve it of gas. The balloon, mounting upward, sailed off toward Lake Erie. Some days after it was found near the St. Clair river, and on the 6th of October the body of the unfortunate was found about ten miles from the place from which he was carried.

THE BALLOON IN WAR.

Balloons have played an important part in war, and the British government is now introducing a department of balloons as a branch of the service.

In 1794, at the battle of Fleurus, several balloons were sent up, retained by means of long cords, and the captains, placed in their car, were able to transmit their orders to their men below by means of colored flags. By this means an important advantage was gained, and the battle was won.

During the rebellion balloons were frequently used, and at Island No. 10, especially, rendered great service. During the siege of Paris by the Germans, the balloon for four months afforded the sole means

of departure from the capital, and many letters and dispatches were transmitted. Gambetta made a noteworthy escape from Paris by this means during the siege. Sixty-four balloons altogether were sent up during the siege.

THE LONGEST BALLOON VOYAGE.

The thirtieth of the series, *Ville d' Orleans*, a balloon of 70,400 cubic feet capacity, ascended Nov. 24, 1870, under the management of M. Rolier, and a *franc tireur*, named Deschamps, conveying 700 pounds of dispatches and six pigeons. The ascent was made in a drizzling rain at 11 o'clock at night. In a few moments the balloon reached a height of 8,100 feet, and kept at about that altitude the whole night. Towns and villages rapidly succeeded each other in the intervals of the clouds. About half past three a sullen and prolonged noise was heard, which was at first taken for a railway train. The day broke later, with a light fog covering the earth. M. Rolier determined to descend naturally, without opening the valve, in order to ascertain his position, and the cause for the noise which he continued to hear. In proportion as he approached the earth, he perceived first a dark ground, which led him to suppose he was over a great forest; then the color became bluish. Examining it attentively, he distinguished small spots scattered all over the surface, and he thought that the earth was covered with snow, partly melted. All this, however, did not explain the constantly increasing roar that struck his ears, and which greatly perplexed him.

The balloon descended slowly and majestically, without, however, affording to the aeronaut any explanation of the menacing and constant roaring, and which was becoming to him a source of no little anxiety. In fixing his gaze on one of the white spots, he thought he perceived it moving; his attention became concentrated on it, and he acquired the fearful certainty that all these spots formed and disappeared alternately, like the foam of the waves. A cold sweat covered him from the crown of his head to the soles of his feet; the balloon was floating over the sea. This was the unceasing noise which had pursued the travelers for three hours.

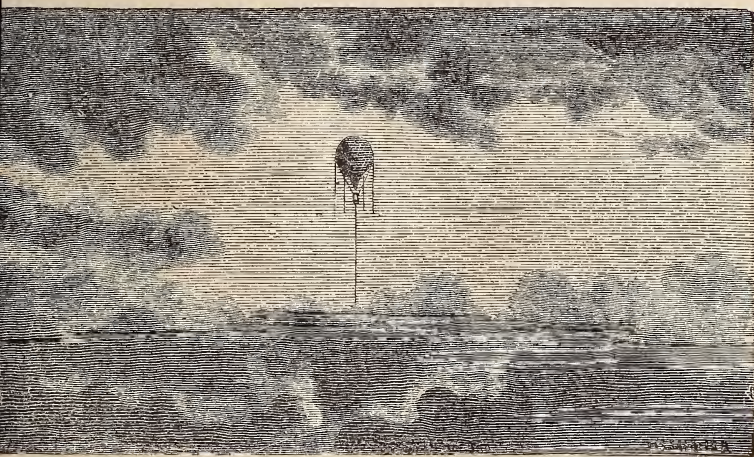
OUT ON THE OCEAN.

The dispersion of the fog at the first rays of the sun gave them the means of confirming this conviction, and of perceiving the faint outlines of the land, at a very great distance, to the west. Recovering from this first emotion, and having reassured his fellow voyager, M. Rolier coolly examined the situation. It was terrible. The barometer indicated only 1,500 feet of height, and the balloon, which by the expansion through the solar heat, had lost a part of its gas, in its lower

part was flabby and flapping. Below, in all directions, was the ocean. To have a chance of safety, it was above all things necessary to arrest the loss of gas. Climbing up on the shoulders of his companion, M. Rolier drew himself up in the ropes to shut the neck of the balloon by means of a tightly drawn cord. As the balloon yet descended, and as there was need of economizing the sand ballast, M. Rolier threw over a package of "*Proclamations aux Allemands.*" Perceiving some vessels on the horizon, he had an idea of availing himself of the possible approach of one of them to let himself down and be saved. A steamer had signalled the balloon by firing a cannon ; but descending always, it was driven along with such a whirling velocity, that it had passed the steamer several kilometres, when the guide rope began to drag in the water. Nothing in truth indicates to the aeronaut the rapidity of his flight, when he has not a fixed point in view ; for the balloon is surrounded by a stratum of air, that advances simultaneously with it, and which appears immovable to the aeronaut whatever may be the speed at which it moves. Now, the *Ville d' Orleans* was clearing the space with the prodigious rapidity, as will be seen hereafter, of 120 miles an hour. The car was only a few feet above the sea ; and an instant afterwards the strong shock of a wave almost upset it.

FLYING ABOVE THE WAVES.

Quick as a thought, the voyagers endeavored to bring back the guide



THE BALLOON, IN LESS THAN A QUARTER OF AN HOUR, REACHED A HEIGHT OF 15,600 FEET.

rope, but in vain. A furious wind assailed the balloon and caused it to incline on its side ; the foam of the waves cover the areonauts, who

throw over several bags of ballast and cut the rope by which a package of sixty-five kilogrammes of private letters was attached to the car. Safety was at this price, for there was not yet a moment to lose. The balloon, relieved of a considerable weight, bounded into the air with a terrifying velocity, for the expansion of the gas could have produced an explosion. M. Rolier hastened to provide against this danger by opening the neck to let the excess of gas escape. This precaution was indispensable, for the balloon, in less than a quarter of an hour reached a height of 15,600 feet.

We may say, *en passant*, that the package of dispatches thrown into the sea was not lost, as may be seen by the following paragraph from the *London Times*: "The Dantzic, of Christiansand, arrived at Leitch, Scotland, on the morning of the 30th of November, 1870, with a box containing sixty-five kilos of letters picked up by fishermen."

In the meanwhile, the balloon plunged with increasing intensity into the mists, and the compass indicated a slight change of direction; it veered towards the east and kept at a constant elevation.

If the observation of the compass is by no means easy for the aeronaut, on account of the continued mobility of the needle, occasioned by the rotary movement of the balloon around its axis, the observations of altitudes present also certain difficulties. The improved barometers of Messrs. Lion & Guichard obviate this in great part, but another apparatus of their invention, applied for the first time in the *Ville d' Orleans*, enabled M. Rolier to ascertain at any moment if his balloon was ascending, descending, or pursuing a horizontal direction. This apparatus consists of a metallic arrow, suspended horizontally above the basket, and having for barbs a large leaf of thin pasteboard. At rest, and during the horizontal movement of the balloon, the equilibrium of the arrow is perfect; if the balloon rises, the resistance of the air acts upon the leaf, and causes the elevation of the arrow point; the contrary takes place when the balloon descends, and the air pushes the leaf up and down.

DESCENDING.

When the observation of the barometer became impossible, on account of the fog and hoar-frost, the arrow indicated to our voyagers that the balloon, losing its gas, was slowly sinking. They determined again to close the neck of the balloon, and M. Rolier mounted in the cords to execute this manœuvre, rendered very difficult by the intense cold, which had stiffened and frozen the material of the balloon. The thermometer marked thirty-nine degrees below the freezing point; the car was filling with congealed rain, and the balloon and ropes were literally covered with ice. The garments of the unfortunate voyagers

were frozen ; their faces and hair were covered with hoar-frost, and they suffered an intense thirst from the rarefaction of the air.

Notwithstanding their efforts to stop the escape of gas, the balloon kept descending. On the scattering of the fog they were struck with the magic spectacle of the balloon, covered with innumerable needles of ice, glittering like an immense globe with a thousand fires in the sun's rays, and constellated, as it were, with diamonds.

This clearing-up spell was followed by another fog accompanied by a sound so strange, that M. Rolier attributed it to the whirlpool of the Maelstrom, and by a stifling sulphurous odor which produces a violent headache and rendered it difficult to breathe. This phenomenon arose from the electrified clouds which the balloon traversed. The observations M. Rolier had the courage and *sangfroid* to take in this more than critical situation, became some months since, at the French Academy, the subject of a conference by M. Becquerel, one of the most erudite members of that assembly.

As the balloon descended, grayish spots were perceived beneath, like strips of muddy water. They might be sand-banks, and hope returned to the hearts of the voyagers, when sinister crackings in the envelope of the balloon admonished them of a new danger. This envelope frozen by the cold of the high regions of the atmosphere, threatened to yield to the tension caused by the dilation of the gas as the balloon descended. M. Rolier slipped out on the ring and moderated the escape of gas, which was violently rushing out through the neck. It became necessary to suffer a certain loss, to avoid an immediate explosion, and in the meanwhile, to prevent as much as possible the waste of gas.

THE PINE FORESTS.

While he was in the ropes his companion called his attention to certain undulations of the guide rope, the cause of which could not at first be recognized on account of the fog. But on examination with an attendant and a feverish emotion that any one can appreciate, their eyes fatigued by the monotonous whiteness of the fog, they seemed to distinguish a black point. M. Rolier instantly seized the cord of the valve, and requested his companion to hold in readiness a bag of ballast for any contingency.

Meanwhile the black point became darker and colored to green, leaving no doubt that it was the top of a pine tree. How the unfortunate voyagers, who for more than eight hours believed themselves doomed to certain death, now felt, may be more easily imagined than described.

They opened entirely the valve, threw over the anchor, and the balloon striking the ground, the car sank in the snow.

Rolier jumped on the ground, but the *franc-tireur*, whose leg was

caught in the anchor ropes, could not free himself, and the balloon, relieved of the weight of one of its tenants, dragged the other along with it. Rolier clung to one of the dispatch bags hanging around the car, but he could only break a little the ascent of the monster, which was furiously cracking and snapping the pines it came in contact with like wisps of straw. The *franc-tireur* at last succeeded in getting his leg loose, and the aeronauts let themselves fall from the height of about forty-five or fifty-five feet. Fortunately a deep bed of snow was there to receive them and break their fall, which was harmless. Rolier got on his legs and holding on to the guide rope, tried to stop the balloon; the rope, however, slipped through his hands, and the balloon disappeared in the air with all its contents, including the case of carrier-pigeons, the letters and the provisions.

IN AN UNKNOWN LAND.

After the first emotion of inexpressible joy on touching *terra firma*, our voyagers devoted themselves to the examination of their new situation. This was not by any means encouraging. After having passed fourteen hours and forty minutes above the clouds, they found themselves on Friday, November 25, at 2 o'clock and 20 minutes P. M., alone without provisions or arms, upon an unknown land. The snow was falling in great flakes, and already covered the earth to the depth of twenty-one inches. A mountain peak of prodigious height, covered with ice, rose before them to the west, and an immense pine forest surrounded them on all sides. Everything indicated a desert country, without any signs of human habitation.

They resolved to march to the south, and they advanced in this direction for some time, having the snow knee deep, and descending with difficulty the declivity before them, losing their foothold, and slipping and supporting themselves as best they could, by the pine branches. An incident broke the monotony of their fatiguing journey. Three huge wolves crossed their path at about three hundred feet distance, and, though they moved quietly on their way, they nevertheless gave our travelers cause for serious reflection.

After three hours' walking, M. Rolier sank exhausted to the ground. The *franc-tireur* who, in the balloon, had been weak and irresolute, recovered his energy on touching the earth. He made a sort of bed of a great pine branch, and placed upon it his sleeping companion. He then set about to look out, in the vicinity, for some better shelter to pass the night; and he discovered an abandoned cabin, the roof of which had been crushed in by the snow, and which contained some hay. Having swept away the snow, the travelers buried themselves in

the hay up to their eyes, and made themselves as comfortable as possible.

THE WATCHES OF THE NIGHT.

This was only comparatively, however. Exhausted by fatigue, suffering fearfully from hunger and cold, Rolier was a prey to a violent fever, which kept him awake a long time. An aurora borealis shed its strange light on the savage scenery around them. After having slept some hours, while his companion kept guard, Rolier, in his turn, mounted guard during the slumber of the *franc-tireur*.

Daylight found them on their feet, and their first care was to provide themselves with stout traveling sticks from the forest, out of which they had not yet issued. During this proceeding, as they again perceived fresh tracks of a herd of wolves, they hastened to quit this ill-omened locality, and directed their steps further to the south. Soon the track of a sleigh and the print of a horse's foot in the snow came to revive their courage. They followed this precious guide during three-quarters of an hour, until it brought them to an isolated hut half buried in the snow, and before which stood a sleigh laden with hay. Their joy was great, for the absence of snow on the hay indicated that the sleigh had been recently laden, and led them to believe in the presence of some human being. They halted, however, hesitating to advance, for the appearance of this miserable hut was not very reassuring. What kind of a reception could they expect from the inhabitants of this cabin, the only opening of which was a door, and the windows of which were closed by skins?

SIGNS OF CIVILIZATION.

They entered; not a solitary creature—an empty room; an opening in the roof served as a chimney; some smoky faggots on the ground, alone attested the recent departure of the natives. In a corner was a bed of hay on four planks, and covered with a skin. Before the bed were a pair of well cut wooden shoes, and upon plank shelves on the wall, some plates and stone-ware pots. To complete these signs of civilization, there were a coffee-pot, with the mark of coffee yet warm, a zinc vase, containing cooked potatoes, and a pot of sour milk. The starved travelers devoured a part of the supplies of their unknown hosts, not desiring to appropriate the whole, through fear of exciting their displeasure. They next made a fire to warm themselves, awaiting, meantime, and not without some apprehension, the return of the natives, respecting whose nationality they indulged in the most improbable conjectures. Upon this subject they could get no information.

The fire blazed, and, thanks to the beneficent influence of the heat, and the satisfaction given to their famished stomachs, they became more

sanguine and courageous. Their investigations led to the discovery of some pairs of well-made woolen stockings, which they were engaged in trying on, when they heard a voice outside calling: "Clas! Clas!" They rushed to the door, and beheld two men coming toward them, and leading a little horse, harnessed to a sleigh.

Rolier advanced to meet them, saluted them, and received in response a very reassuring greeting. The conversation soon took a most sympathetic tone; only the natives did not understand a single word of what the Frenchmen said to them, who, likewise, on their part, comprehended absolutely nothing. It was necessary to have recourse to pantomime, which was a perfect success, for these excellent natives hastened to serve their guests with the best of their larder; rancid lard and strange sausages, and making themselves as hospitable as possible.

Towards the end of the repast, the coffee which they called *kafie*, proved that it would not be altogether impossible to find some words common to the two languages, at least nearly so. While the Frenchmen were sipping the coffee, Clas (for this was the name of one of the natives) closely inspected the torn boots which M. Rolier had placed to dry before the fire. All of a sudden, Clas, who had just read the address of the boot-maker, striking his forehead, cried out: "Paris, Paris, French!" and the two natives rushed to the Frenchmen, repeatedly and affectionately shaking them by the hands.

M. Rolier, calling now the pencil to his aid, succeeded, by a sketch, in making them understand how he became their guest, for his interlocutors answered: "*Ja, ja, bailoun, balloun.*" He had not yet, however, himself obtained any precise knowledge as to the country where he found himself. Proceeding to light a cigar, he perceived a box of matches, which gave him at last some information on this head. This box bore the inscription: "Nitedals Taendstikkere, Pi Sund, Christiania." They were then in Norway.

NEARLY 2,000 MILES IN LESS THAN FIFTEEN HOURS.

The *Ville d'Orleans* had traveled 1,950 miles in less than fifteen hours, and had deposited M. Rolier upon Mount Lid (*Lidfiela*), at the foot of one of the highest peaks of the Scandinavian cordilleras, in the province of *Thilcmarken*. It had then resumed its wild course, and finally came to the ground sixty-two miles to the north-west of Mount Lid, at Kroedershea, where it produced a great fright among the superstitious people of the country. According to all probability, the balloon had quitted France above Dunkirk; had crossed England, turning afterwards to the east, and taking the open sea as far as the heights of Sandal Norway; thence inclining to the northeast, it crossed a space of about 160 miles, passing above uninhabited provinces of Norway, where

no human succor could have reached the aeronaut, and which, fortunately, a dense fog obscured from his sight. After learning his situation, and, without losing time, M. Rolier engaged the brothers Clas and Harold Strand to convey him in a sleigh, to the neighboring village of SligJord. He had yet in his possession the despatch for the government at Tours, to which chance had given such an immense detour, and which he was desirous of expediting to its destination. He set out for Christiana, traveling this distance of 160 miles in sleigh to Houg-sund, and thence by rail.

ENTHUSIASTIC RECEPTION.

The cordial reception given to the French travelers, whose miraculous arrival had produced the most enthusiastic excitement throughout the country, transformed their journey into a continued series of ovations. A dispatch of M. Hept, French Consul-General at Christiana, December 3, 1870, to Comte de Chandordy, Acting-Minister of Foreign Affairs, contains a glowing picture of the demonstrations of sympathy, and of admiration for his courage bestowed on M. Rolier by the population of Christiana, Kongsberg, Drammen, and other points of Norway through which he passed. A *fete* was given in his honor at the Capital by the notables of the bar, the army and navy, the government officers, and by the leading merchants. His progress, in fact, everywhere throughout the country, resembled a triumphal march, the population turning out on all sides to honor him.

The first care of M. Rolier, on his arrival at Christiana, was to telegraph to Tours, in cipher, a copy of the dispatch entrusted to his charge. He offered his balloon to the University of Christiana on condition of its being exhibited for the benefit of the victims of the war, and he authorized the sale of his portrait, and of a commemorative medal, made of alloy, in which the metal of his electric batteries was mingled. The product of these operations, and the subscriptions of the Norwegians in favor of the French wounded, in three days amounted to nearly \$5,000. This sum M. Rolier delivered to the government at Bordeaux, when he arrived there to render an account of his mission. In recognition of the brilliant manner in which he had performed it, he was appointed Chevalier of the Legion of Honor, and Officer of the Order of Saint Olaf of Sweden.

300 MILES IN SIX HOURS.

One of the most notable balloon ascents from Paris during the siege, was that of the *Volta*, the thirty-fifth of the series, containing 72,000 cubic feet. It contained Dr. Janssen, who left, charged with a scientific mission to Algeria. He embarked Dec. 2, 1870, at 6 A. M. The bal-

loon arose at once to a height of 7,200 feet and descended shortly before noon, at St. Nazaire, accomplishing a journey of 300 miles.

FROM PARIS TO ICELAND.

In 1876, the remains of a balloon were found on the coast of Iceland. In the car were human bones—an incomplete skeleton—and a leather traveling bag, containing papers so mouldy as not to be deciphered. It is conjectured that this was the balloon *de Jacquard*, that ascended with Prince, a seaman, alone, from the foot of Montrouge on Nov. 28, 1870, during the siege of Paris. This balloon contained 550 pounds of dispatches, and was last seen above Rochelle. A bag of dispatches from this balloon was picked up in the channel. Whether Prince was killed while attempting to land in Iceland, or whether he was drowned near the coast can only be conjectured.

THE ZENITH DISASTER.

One of the most lamentable examples of carelessness is furnished in the fatal ascent of the *Zenith* balloon, made under the auspices of the French Aerial Navigation Society. By its direction MM. Croce-Spinelli and Sivel, made in 1874, an ascent to a height of 23,900 feet, noting many valuable observations. In 1875, it was decided to make two scientific voyages; one of great duration, the other to a great height.

THE ASCENT OF LONGEST DURATION.

The balloon *Zenith* ascended on the first of these from Paris with MM. Sivel, Croce-Spinelli, Albert and Gaston Tissandier and Jobert at 6.20 P. M. on March 24, 1875. They were provided with a drag rope 2,600 feet long. The balloon passed over Paris, maintaining an altitude of from 2,300 to 3,600 feet. Their direction was north north-west oceanward. They descended from this altitude and at a height of 300 feet encountered a cool breeze which took them inland again, and in a southerly direction. Finally, twenty-two hours and forty minutes after having left the earth the voyage terminated at Montplaisir, near Bordeaux, about 300 miles from Paris. During the night they beheld the moon encircled by a splendid cruciform halo. Their highest altitude on this voyage was 3,930 feet.

THE UNINHABITABLE HEIGHT.

This ascent had been so successful that it was determined to ascend to the very highest point at which it was possible to sustain life, and on the 15th of April, 1875, Gaston Tissandier, Croce-Spinelli and Sivel ascended again in the *Zenith* from Paris, at 11.32 A. M. They were

provided with an aspirator and an oxygen apparatus, for inhaling pure oxygen.

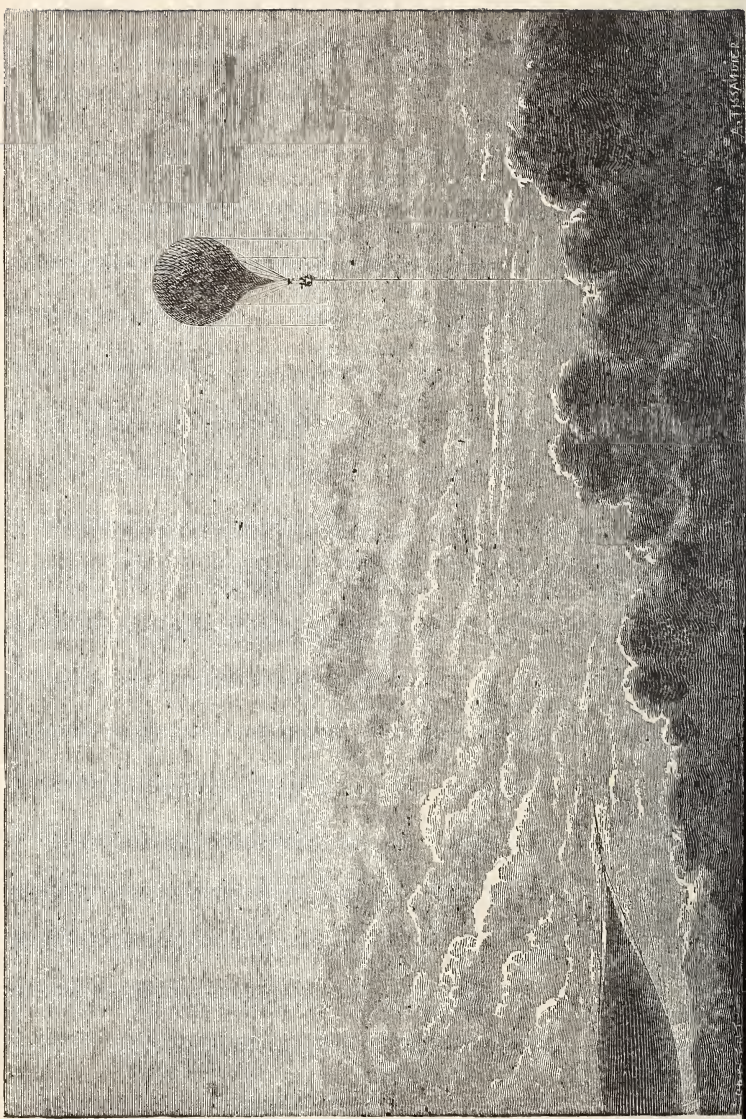
All went well for the first hour and a-half, but in ten minutes more, at the altitude of three and three-quarter miles, the aeronauts began to be distressed, their hands were frozen, and breathing became difficult ; their spirits, however, did not flag. After inhaling a little oxygen they felt better, Sivel threw out some ballast, and the balloon mounted still higher. Suddenly all three became powerless and fell senseless, Tissandier retaining consciousness to the height of a little over five miles. It was then 1.30 P. M. At 2.08 P. M. Tissandier and his companions regained their senses, found the balloon to be rapidly descending, and in order to stay the descent Spinelli threw out quantities of ballast and an instrument for breathing air, termed the *aspirateur*, which weighed eighty pounds. The balloon once more ascended, and again the occupants became unconscious. At 3.15 Tissandier regained his senses, found the balloon to be descending at a frightful speed, and his two companions lying dead at the bottom of the car, their faces black and their mouths covered with blood.

THE SURVIVOR'S NARRATIVE.

M. Tissandier's account of the catastrophe is given in his own words :
" I arrive at the fatal moment when we were seized with the terrible influence of the atmospheric depression. At 22,900 feet we were all standing in the car ; Sivel, for a moment bewildered, recovers himself ; Croce-Spinelli is unaffected. " See," says the latter ; " how beautiful are these cirrhi ! "

In a word it was beautiful, this sublime spectacle above us. Cirrhi of various shapes formed about us a circle of a silvery white. Away below the car we could behold the earth's surface, as at the bottom of a well, the walls of which these clouds formed. The sky, far from being dark and profound, was of a clear and limpid blue ; the burning sun almost scorched our faces. Meanwhile the cold began to make its influence felt, and we had already placed our wraps about our shoulders. A dazed feeling seized me, my hands were cold and frozen ; I desired to put on my fur gloves, but without noticing it, the act of taking them in my hands required on my part an effort which I could no longer make. At this height of 22,900 feet I wrote almost mechanically in my note-book. I transcribe literally the following lines ; the exact moment of writing them I cannot remember, but they are traced in a scarcely legible manner, by a hand which the cold had caused to tremble excessively :

" I have frozen my hands. All goes well. Fog on the horizon, with small, rounded cirrhi. We are ascending. Croce is panting. We breathe oxygen. Sivel closes his eyes. Croce also closes his eyes.



Temperature,—10 degrees 1 h. 20 m. P. M. Sivel is drowsy—1 h. 25 m. Temperature,—11 degrees. Sivel throws out ballast—Sivel throws out ballast."

These last words are barely legible. Sivel, in fact, who had been for some moments quiet and motionless, occasionally with his eyes closed, recovered himself, doubtless with the idea that he desired to exceed the limit to which the *Zenith* had previously ascended. He raised up, erect; his energetic face suddenly lit up with an unaccustomed glow. He turned towards me and said:

"What is the pressure?"

"Three hundred" (about 24,500 feet high).

"We have lots of ballast—shall I throw out some?"

I answer him:

"Do as you like."

He turns towards Croce and puts the same question to him. Croce nods his head very decidedly in token of affirmation. There were in the car at least five bags of ballast; there were besides nearly as many hanging outside by cords. These latter, I should add, were not entirely full; Sivel certainly knew their weight, but I cannot state exactly what they did weigh. Sivel takes his knife and cuts successively three cords; the three bags empty themselves, and we ascend rapidly. The last clear recollection of this upward movement goes back to a moment previous to this. Croce-Spinelli was seated, holding in his hand the mouthpiece of the oxygen apparatus; his head was slightly inclined and he seemed fatigued. I had still the power to strike with my finger the aneroid, in order to facilitate the movement of the needle; Sivel had just raised his hand as if to point to the upper regions of the atmosphere.

Though I was not absolutely prostrated, I had without doubt already lost the power of moving. At the height of nearly 25,000 feet, the state of lassitude which one experiences is extraordinary. The body and mind become enfeebled, little by little, gradually, insensibly and imperceptibly. There is no suffering; on the contrary, one experiences an internal delight, and it is the feeling of a ray of light pouring in upon one. One becomes indifferent, thinks not of danger; one ascends, and ascending is happy. The vertigo of the upper regions is not an idle word; but as far as I can judge by my personal impressions, this vertigo affects one at the last moment; it immediately precedes utter prostration, but it is sudden, unexpected and irresistible.

When Sivel had cut loose the three bags of sand at the height of about 24,500 feet, I believe I recollect his sitting on the bottom of the car, where I was lying. I was feeling so weak that I was unable to turn my head to look at my companions. Presently I wanted to take

hold of the oxygen tube, but it was impossible for me to raise my shoulders. My mind all the while was very clear. I was steadily regarding the barometer, I had my eyes fixed on the needle, which soon reached the figure 290, then 280, which it passed. I cry out, "We are at 26,200 feet!"

But my tongue is as if paralyzed. All at once my eyes close; I fall helpless, and recollection departs. It was about half-past one. At three minutes past two, I awoke for a moment. The balloon is rapidly falling. I was able to cut loose a bag of ballast, with the idea of checking the descent, and to write on my register the following lines :

"We are descending; temperature,—8 degrees; I throw out ballast. We are descending. Sivel and Croce are still motionless on the floor of the car. We are going down very fast."

Hardly had I written these words when a kind of trembling seized me, and I fell exhausted. The wind came up with violence, denoting a very rapid descent. Some moments after, I felt myself shaken by the shoulder, and I recognized Croce who had recovered.

"Throw out ballast," he says, "we are falling."

But it was with difficulty that I opened my eyes, and I had not seen if Sivel was aroused.

A FATAL MISTAKE.

I recollect that Croce detached the aspirator and threw it out, and that he threw out ballast also. All this is a confused and brief recollection, for I relapsed into a state of insensibility more complete than before, and it seemed to me that I was wrapped in an eternal slumber. What occurred? It is certain that the balloon, relieved of its ballast, impermeable as it was and much heated, remounted again to a great height.

At 3.30, about, I reopened my eyes, felt myself weak and exhausted, but my senses had returned. The balloon descends with frightful velocity, the car sways to and fro, oscillating violently. I drag myself to my knees and take hold of Sivel and Croce by the shoulders. "Sivel! Croce!" I cry, "wake up!"

My two companions were crouched down in the basket, their heads hidden under their neck wraps. I exerted my strength and tried to rouse them. Sivel was black in the face, the eyes were without expression, his mouth was open and filled with blood. Croce's eyes were half closed and his lips were bloody.

To narrate in detail what passed after that is impossible. I felt a frightful wind coming up from below. We were still 23 000 feet high. There were two bags of sand in the car, and these I threw out. Soon

I neared the earth, and felt for my knife in order to cut the cord with which the anchor was tied; I could not find it. I was half crazed and continued to shriek "Sivel! Sivel!" By good luck I put my hand on a knife and so detached the anchor at the right instant. The shock of the landing was extremely violent. The balloon seemed to flatten out and I believed that it was going to remain fast. But the strong wind carried it along, the anchor did not hold, and the basket bounded along the ground. The bodies of my unfortunate friends were jostled about and nearly thrown out. Finally I seized the valve-cord, the balloon speedily emptied itself, and collapsed against a tree. It was then 4 o'clock. I had landed in the fields near Ciron, 156 miles from Paris.

An examination of the self-registering instruments showed that we had attained an extreme altitude of between 28,000 and 28,200 feet. I have no doubt that the death of Croce and Sivel was caused by the want of air, resulting from the atmospheric depression. It has been supposed by some that the accident was caused by their inhaling the escaping gas of the balloon. I am persuaded that this is not so. In many previous ascensions, I have experienced the odor of gas escaping much more freely than it did on this ascension, and neither myself nor my companions have suffered any serious effect. The neck of the balloon is far enough from the car to enable the gas to mix freely with the air, which would very greatly diminish its effect. Croce-Spinelli and Sivel were still living after having attained a height of 26,200 feet; they met their fate on the return of the balloon to the upper air, when the *ærostat* had lost nearly all the gas that could escape by the neck."

The cause of the catastrophe is mainly attributed to M. Croce-Spinelli having thrown over a weight so heavy as the aspirator, doubtless through loss of presence of mind. M. Tissandier, the survivor, was, curiously enough, the oldest and least robust of the three. It is his belief that M. Glaisher could not have ascended to the height he records, as in so doing he and his companion must have perished.

Sivel, who had been a naval officer, had made more than 150 ascents, and Tissandier had ascended nearly thirty times, while Spinelli, a frequent voyager of the air, had made a study of the atmosphere.

DURUOF AND HIS WIFE IN THE SEA.

M. Duruof, a well-known French aeronaut, announced that he, with his wife, would attempt to cross the English Channel from Calais, on August 31, 1874. The balloon was inflated, but the wind was unfavorable, and a postponement was announced. On his return to his hotel, he was taunted with cowardice by the crowd. This offended both him and his wife, and they left the table abruptly, saying that they

would show the Calais people that they were not afraid to die. After having attached his car hurriedly to the ring, he ascended, taking his wife with him. The woman was more enraged and determined than her husband. She had no bonnet nor shawl. They ascended at 7 P. M., with only a few sacks of ballast, weighing about twenty pounds each. In ten minutes they were out of sight in the dark, traveling at a fearful rate towards the open sea, and in a north-north-easterly direction. Night came on, and the aeronauts, thinly clad and without provisions, suffered greatly. They drifted about the whole night, and when daylight came, they found themselves over the North Sea. M. Duruof, not knowing how far he was from land, manœuvred to descend, in order to get picked up by some vessel. They had been ten hours in the air, and were now doomed to be dragged two hours through the water, for, though they were seen and chased by a fishing smack, it was quite that time before they were overtaken. The balloon, dragging with the car half under water, was every moment in danger of bursting, but at last the captain and mate of the smack *Grand Charge* reached them, and with great difficulty managed to get them into their yawl. The balloon went off at a great speed towards Norway and was lost.

ANOTHER DESCENT IN THE OCEAN.

August 21, 1876, Duruof, with another gentleman, ascended from Cherbourg at 4.45 P. M. The wind carried the voyagers out to sea. Duruof hoped to rise into an upper stratum moving in a contrary direction, which would bring him back to land; but not meeting with this after mounting to a height of 12,000 feet, he determined to descend into the sea, where, by the orders of the Port Admiral, four steam launches and a tug-boat were on the lookout for him. Duruof had made preparations for this feat, corks being affixed to the car of the balloon, and a friction cone being lowered into the water, to serve as an anchor to the balloon. Just at the moment when the cone reached the sea, Duruof threw out eleven bags of ballast, but although this naturally increased the upward tendency of the balloon, the cone held it fast, and presently the crew of one of the steamers caught the ropes thrown out by the aeronauts, and hauled her down so steadily that the balloonists stepped from the car on to the steamer's deck, as from a carriage.

THE TRAGIC HISTORY OF DONALDSON.

The record of no aeronaut possesses a more romantic or melancholy interest than that of Washington H. Donaldson, who perished like De Rozier at the very time when success and popularity seemed most assured. Donaldson was born in Philadelphia in 1840. Possessing an admirable physique and superabundant energy, his propensity for an

active, restless life early developed itself. Breaking away from all restraint before he had acquired more than a very ordinary education, he appeared on the stage of a variety theatre as a gymnast, and for a number of years followed the calling of a variety performer, at times trapezist, ventriloquist, and magician. He became very expert as a tight rope walker, and in 1862 walked across the Schuylkill river on a rope 1,200 feet long, ending by jumping into the river from a height of 90 feet. Two years later he walked a rope over the Genesee river at Rochester, N. Y., 1,800 feet long. From 1857 to 1871 he travelled throughout the United States, appearing some 1,300 times in various variety theatres. In 1871, on August 30, he made his first balloon ascent in an old balloon called *The Comet*, from Reading, Pa. The balloon held about 9,000 feet of gas, and the aeronaut ascended without any previous knowledge of the principles of air traveling, but with that perfect confidence which he always possessed. The balloon was so small that all the ballast had to be thrown out before it would rise, and then it lodged on the roof of a house near by. The adventurer then threw out his rope, coat, boots and hat, when the balloon rose gracefully to the height of about a mile and a quarter. It descended in a ploughed field some 18 miles distant from the town. This ascension was designed by Donaldson simply as a means of attracting attention to a variety performance that he gave the same evening, but the sensation of the trip was so delightful that he determined at once to adopt the calling of an aeronaut.

On the 4th of September Donaldson made a second ascension in *The Comet* from Reading, attired in circus costume and balancing himself upon the bar of a trapeze. As the balloon ascended he performed a series of difficult feats upon the trapeze, and these he continued until out of sight. At the height of a mile he pulled the valve cord, and with such strength that the balloon was torn and the gas escaped so rapidly that the descent was sudden and violent, giving the aeronaut a very severe shock. From this time on Donaldson ascended from various places, and on every occasion with his trapeze bar, attracting much attention, but securing so little pecuniary advantage that he was unable to provide himself with such an outfit as a prudent aeronaut would deem necessary. On January 18th, 1872, he ascended from Norfolk, Va., and at the height of a mile burst his balloon by a too forcible use of the valve cord. As Donaldson states, "The balloon did not collapse, but closed up at the sides, and swaying from side to side, descended with frightful velocity. I clung with all my strength to the hoop. I could not tell how badly I was frightened, but felt as though all my hair had been torn out. I scarcely had time to realize that I was alive, when with a crash I was projected with the velocity of a catapult into

a burr-chestnut tree. The netting and rigging catching in the tree checked my velocity, and I had my grasp jerked loose, and was precipitated through the limbs and landed flat upon my back, with my tights nearly torn off, and my legs, arms and body lacerated and bleeding. On examining the balloon, I found the valve close as a bottle and turned inside the balloon, which had a rent running from the crown to the neck and was turned inside out." Four days later he ascended again from Norfolk with the same balloon, repaired. He was nearly carried out to sea on this occasion, and only escaped doing so by climbing up the netting and cutting a large hole in the balloon. He was nearly suffocated, but clung to the ring, and the balloon landed him in the top of the *last tree* that separated him from the expanse of water. The balloon was completely wrecked. He then constructed *The Magenta*, which held about 10,000 feet. With this he ascended from a number of points, and on July 4th, 1872, he went up from a beer garden in Chicago, was carried out over Lake Michigan, descended into the lake, and was dragged through the water for over a mile, finally bringing up against a stone pier with such force as to render him senseless. Two days later he had repaired his balloon and made another ascension, was carried out over Lake Michigan, when, striking another current, he was wafted back over the city, and floated for an hour over Chicago, during which he enjoyed a splendid view of the town. The burnt district lay just beneath him and the fallen ruins were imposingly black and desolate. In the fall of that year he ascended from East Saginaw, Mich., and reached a height of 19,000 feet. On May 17th, 1873, he ascended from Reading, Pa., in a balloon constructed of brown manilla paper. It is an illustration of the sublime courage and self confidence of the man that, not having the means to build an ordinary balloon, he was willing to trust his life to an inflated envelope of brown paper, enclosed in a netting made of common fish-line. This balloon weighed complete, 48 pounds, and contained 14,000 cubic feet. His ascension was successful, the aeronaut reaching an altitude of over 2,000 feet, and traversing a distance of ten miles. Immediately after this Donaldson endeavored to procure means in Boston to enable him to attempt to cross the Atlantic. He failed in this, but his effort attracted the attention of the managers of *The Daily Graphic*, who soon after contracted with him and Wise to make the experiment. *The Graphic* people undoubtedly went into the undertaking in good faith. They were led to believe in the existence of a constant easterly air current, but were mistaken in believing it possible to maintain a balloon at the required altitude of two to three miles long enough to make the voyage successful. They placed at the disposal of Wise and Donaldson more than the amount stipulated for as necessary to construct the

apparatus, and everything asked for was provided. They relied upon Wise to superintend the construction, and this he neglected to do. The bulk of responsibility was left upon Donaldson, who had to carry through the construction of the largest air-ship ever built, a balloon holding over 700,000 feet of gas, although he had never used a balloon up to this time of more than 15,000 cubic feet capacity, and had derived no knowledge of aeronautics except what he had obtained unaided in his limited experience. The balloon was constructed, unnecessarily ponderous, but exceedingly strong, and on the morning of October 7th, at ten minutes past 9, *The Graphic* balloon was despatched from Brooklyn in a strong gale, setting directly oceanward. Wise had declined to go, as was expected, and Donaldson ascended, accompanied by two representatives of *The Graphic*. The inflation was very successfully managed by Prof. King, who had been specially engaged for the purpose, as Mr. Donaldson, after two previous attempts, had frankly confessed his inability to inflate and despatch the monster. It was the largest balloon that ever made a free ascension. The wind was favorable and the departure was intensely thrilling and interesting to those who witnessed it. A long voyage was anticipated. The wind blew directly oceanward. The air-ship went off with great speed, and was visible from the point of departure for an hour. It rose to a height of a mile, and was carried nearly as far as Montauk Point, the eastern extremity of Long Island, when it encountered a violent storm moving northward. The balloon finally descended in New Canaan, Connecticut, in the midst of the storm, the aeronauts landing in great peril, but in safety. The boat carried on this trip was very staunch and seaworthy, and weighed nearly two tons. Had Donaldson possessed sufficient skill and experience, he probably would have succeeded in making a voyage of at least 1,000 miles.

TWO REMARKABLE INCIDENTS.

Two very singular occurrences were connected with *The Graphic* balloon enterprise. While this great air-ship was in process of completion Donaldson made a number of ascensions in his small balloon, *The Magenta*, from the grounds in Brooklyn. On one of these trips she passed over a farm-house in the interior of Long Island. The farmer, who had not seen much of the outside world, happened to observe the balloon as it passed over. The shock upset his mind and he became insane, and so remained until his death, which took place in 1878. The other incident transpired on the trip of *The Graphic*. Augustus Hemenway was a well-known merchant millionaire of Boston. He had led an active life and was very successful. It was about the period of the

inception of *The Graphic* enterprise that Mr. Hemenway perceived that his mental faculties were failing him. He put his affairs in perfect order, and, resigning the full charge of his immense business to his brother, retired to a private insane retreat at Litchfield, Conn. While there he was accustomed to read *The Graphic*, in whose illustrations he appeared to take considerable interest. When the balloon project was first broached he took to reading about it, and often talked with the people about him on the subject. His mind had failed him to a large extent, but he had occasional lucid moments. One day, while sitting in the garden attached to the retreat, he looked up and exclaimed, "Why, there's the balloon!" Sure enough, *The Graphic* balloon was at that instant passing overhead. The attention of those about was attracted, and the aerostat was watched until it disappeared from view. From that moment Mr. Hemenway was a perfectly sane man. He immediately returned to Boston, resumed charge of his affairs and conducted them with usual prudence and ability until his death, which occurred some three years later. He left an estate valued at several millions. The truth of this incident is vouched for by the Boston newspapers, from which this account is taken.

WITH P. T. BARNUM.

In 1874 Mr. Donaldson connected himself with the circus of P. T. Barnum as aeronaut, and made many ascensions, going from place to place with the exhibition. On the 24th of July he ascended from Gilmore's garden in a balloon containing 54,000 feet of gas, with five passengers. These he continued to land one after the other as the power of the balloon was lost, but by the aid of the guide-rope he kept afloat for thirteen hours, landing finally at Greenport, near Hudson, 130 miles from New York.

Four days after he ascended again from Gilmore's Garden, with five passengers. He landed two passengers at Camp Hill, Rockland County, three hours after starting, and again ascended. At 2 A. M. he again met the ground in Wallingford, Vermont, and there remained till 8 A. M., when he ascended again, and this time to a height of 13,000 feet. At noon the voyage terminated at Thetford, Vermont, after having traversed 400 miles in all. October 19, in the same year, Donaldson ascended from Cincinnati, taking up a couple who were married in the basket in mid-air.

June 23, 1875, Donaldson ascended from Toronto, Canada, taking with him three reporters. They were carried out over Lake Ontario, were in close proximity during the night to a blazing meteor, and finally through loss of gas, descended to the water, through which they were dragged, clinging to the ropes, for many miles. They were



finally picked up almost exhausted by a small boat from a passing schooner.

He continued with the Barnum show until he met with the terrible disaster that ended his life.

DEATH IN THE LAKE.

This occurred in the night of July 15, 1875. The balloon, named the *P. T. Barnum*, ascended from the Hippodrome, Chicago, at 5 P. M. Donaldson was accompanied by Newton S. Grimwood, of the *Chicago Evening Journal*, who had disputed with another reporter for a seat, and whose fatal lot was decided by the toss of a coin. The balloon held 83,000 cubic feet, and departed with about 800 pounds of ballast. It rose to a height of about a mile and floated to the north-east over the lake, at the rate of about fifteen miles an hour. In about an hour and a half the balloon was out of sight. At 7 P. M., the *Little Guide*, a small craft, standing out some thirty miles from the Illinois shore, sighted the balloon. It was then occasionally dipping its basket in the lake, only a mile and a-half away. The schooner headed for it, but before it could overtake it, there seemed to be a sudden lightening of the car, and the balloon shot upwards to a great height, and soon disappeared. This was the last ever seen of the balloon. That night a terrific storm swept down upon the lake. How the two men met their fate was never known; but on the 16th of August, the body of Grimwood was found on the east shore of Lake Michigan, near Stony Creek. The body was fully identified. It was completely clothed, except that the hat and boots were missing, and around the body was a broken life preserver. Of Donaldson, or of the balloon, no trace has ever been discovered. He perished miserably on his 139th air voyage, unquestionably one of the most intrepid souls that ever lived.

THRICE OVER THE SAME POINT.

Sept. 12, 1876, D. S. Thomas, an amateur aeronaut of some experience, ascended from New Haven, and encountering various currents at different altitudes, as high as 7,500 feet, was enabled to cross back and forth across the city three times within three hours. At one time his balloon went out over the Sound as far as five miles from land.

FLYING MACHINES.

A very great number of flying machines have been designed and projected, but few have ever passed beyond projects. In the still air of a room it is of course not difficult to attach an apparatus to a balloon so as to direct its motion, but there seems little chance of the construction of a satisfactory flying machine unless means can be found to make a steam engine of much less weight than is at present necessary. In 1852 and 1855, M. Giffard, of Paris, than whom no one can be more

anxious to solve the problem of the air, experimented with flying machines, but has never since repeated his experiments in this direction.

DR. ANDREW'S AEREON.

One of the most ingenious of these devices was that constructed by Dr. Solomon Andrews, of Perth Amboy, N. J., in 1863. It was formed of three pointed cylindroids of varnished linen, each eighty feet long and thirteen feet in diameter. They were covered with netting which held a basket suspended sixteen feet below. On the trial trip this apparatus traveled short distances at the rate of twenty-five miles an hour. Its plan of motion was to give it an inclination to the horizon, so that it might rise or fall like the bird; the levity of the gas overcoming gravitation. In 1865 a company was formed to develop the idea. In the spring of 1866 the machine made two excursions from the corner of Houston and Greene streets, New York. On the first it rose a-half mile high, and landed in Astoria. On the second, it rose a mile and a-half high, and descended on Long Island, twenty miles away. It was said on this occasion to have borne up against the wind. Nothing further ever came of this scheme.

Last year Richtel's flying machine attracted some attention. It was an elongated, cylindrical balloon, worked with a fan. While it was possible to operate it in still air, it proved to be nothing new, and was exhibited as a toy.

THE EASTERLY CURRENT.

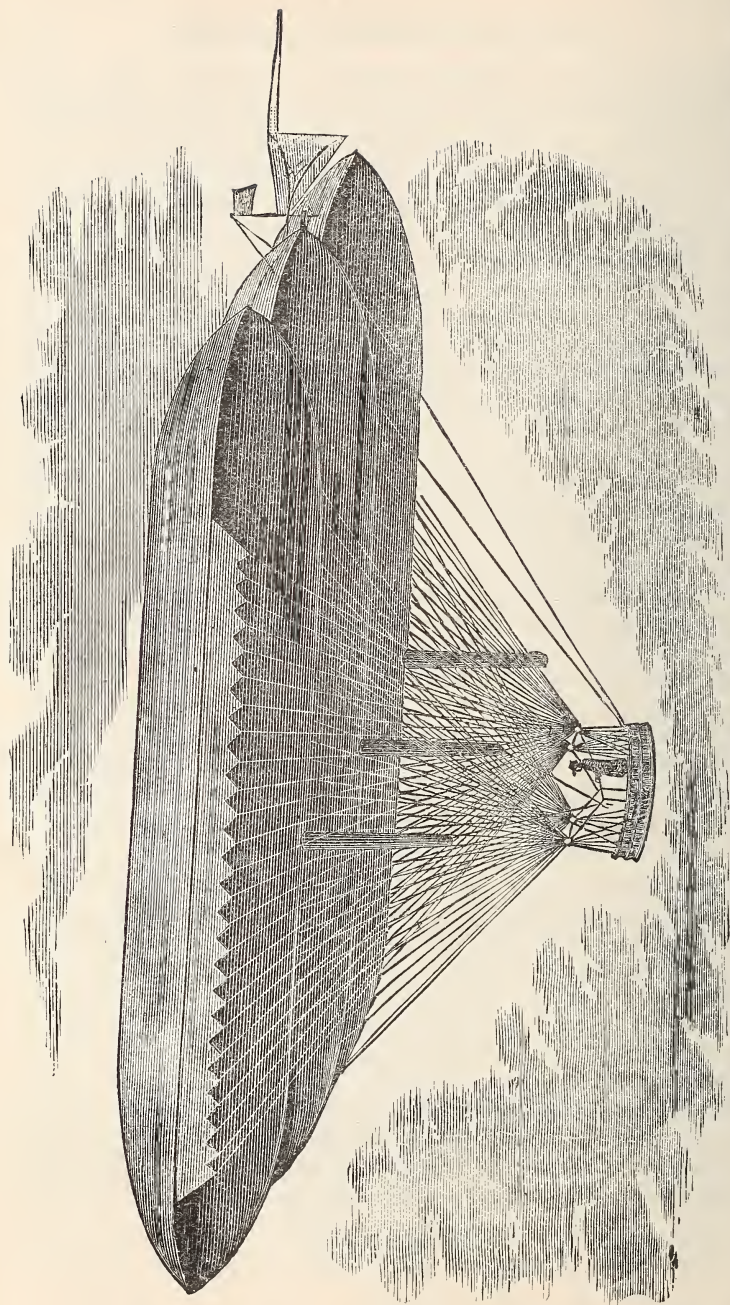
It is the general belief that a continuous easterly current exists at a considerable altitude from the earth, and most aeronauts support the theory; but the difficulty exists of maintaining a balloon long enough at such an altitude to enable it to accomplish any very great distance.

HOW HIGH WILL A BALLOON RISE?

The height to which a balloon will rise is determined from the law according to which the density of the atmospheric strata diminishes as the distance from the earth is increased. The buoyant force diminishes with the density, and when it is reduced to a quantity only equal to the weight of the balloon and its appendages, no further ascension can take place. As the pressure of the external air is diminished, the expansive force of the confined gas becomes greater; and a balloon quite filled at the surface of the earth would be torn to shreds at the height of a few miles, unless a portion of the confined gas were allowed to escape. For this purpose, the neck of the balloon, into which the gas is introduced, is commonly left open, and the machine is also furnished with a safety valve at the top, which can be opened or shut at pleasure.

SUPPOSE IT BURSTS.

A descending balloon, half full of gas, naturally rises to the top of



the netting and assumes the form of a parachute, thus materially lessening the rapidity of descent. In one of Mr. Glaisher's ascents, the balloon was collapsed to avoid going out to sea, and the balloon descended two miles in four minutes. The occupants of the car were unharmed.

The dangers attending the bursting of a balloon in mid-air are generally over-estimated. In a majority of cases, a large surface would be presented to the air in falling by the spreading of the cloth against the top and sides of the netting, and thus the balloon would assume a parachute form and land its passengers in safety.

HOW A BALLOON ACTS.

The balloon usually rises in an oblique direction, under the combined influence of the vertical ascensional force and the direction of the wind. As soon as it mounts into a stratum of air having the same density as itself, it ceases to ascend, unless more ballast is thrown out, and follows the course of the aerial current. As regards the particles of air which surround it, it is quite motionless, as it floats with the air, and the aeronaut may be swept along with the swiftness of a tornado with nothing to indicate to him, unless he can see the earth, that he is not in the quiet of a complete calm. M. Flammarion states that in an aerial journey of 120 miles, he never felt himself in motion, and that from a glass of water filled to the brim, which was placed within the car, not a drop was shaken out, although the balloon was constantly rising and falling hundreds of feet.

APPEARANCE OF THE EARTH FROM A BALLOON.

All perception of comparative altitudes of objects on or near the ground is lost. Everything is reduced to the same level; even the lower detached clouds seem to rest on the earth. Always, however great the height of the balloon, the horizon appears to be on the level of the car. Towns and cities, when viewed from a balloon, seem like models in motion. Mr. Glaisher says: "I shall always remember an ascent when we passed over London about sunset. At the time when we were over 7,000 feet high and directly over London Bridge, the scene around was one that cannot probably be equalled in the world. We were still so low as not to lose sight of the details of the spectacle which we saw; with one glance the homes of 3,000,000 people could be seen, and so distinctly that very large buildings were easily distinguishable. The whole of London was visible, and in some parts most clearly. All round, the suburbs were very distinct, with their lines of detached villas, imbedded, as it were, in a mass of shrubs; beyond, the country was like a garden, its fields, well marked, becoming smaller



A BIRD'S EYE VIEW ABOVE PARIS.

and smaller as the eye wandered farther away. Again, looking down there was the Thames, throughout its whole length without the slightest mist, dotted over on its winding course with innumerable ships and steamboats, like moving toys.

"I have seen London by night; I have crossed it during the day at the height of four miles; I have often admired the splendor of sky scenery, but the spectacle at sunset I have never seen surpassed. The roar of the town was a deep, rich, continuous sound; but at the height of four miles, all was hushed; not a sound reached our ears."

CONCAVE APPEARANCE OF THE EARTH.

Not the least remarkable phenomenon which presents itself to the aeronaut is the concave appearance of the earth, which arches beneath him as the sky does above, so that he may be said to float between two vast concavities.

THE SENSATION.

However much you may be made giddy on a house-top or at an upper window, dizziness never affects you in a balloon. Dizziness is something wholly unknown to balloon travellers. Nor is there any sensation of being drawn swiftly through the air, as there is in a common swing, a fact that is easily explained when it is remembered that the balloon necessarily travels with the moving current of air, at the same velocity as the air itself. There is no sensation of motion whatever, and when one withdraws his gaze from objects below, the balloon seems to be poised perfectly still in the air, although it may be moving onwards at the rate of thirty, forty or fifty miles an hour. While enveloped in the clouds, or in close proximity above them, this singular phenomenon is all the more striking, for every perceptible object around you or beneath you seems relatively becalmed. So far as dizziness is concerned, it might possibly ensue in case the passenger was seated on top of the balloon, instead of being suspended beneath it with no point of reference between him and the earth. So motionless does the balloon seem, that it often becomes necessary to watch given points below with the closest scrutiny, and to throw out streamers or bits of paper in order to detect its actual direction. In rising or falling very rapidly there is sometimes the merest ripple of air, but even an upward or downward motion of the balloon cannot be detected ordinarily, without the use of streamers, flags, or pieces of paper. If the balloon is going up, the flags and streamers hang straight and motionless. If it is falling, the resistance causes them to wave or rise, and bits of paper from descending so much slower, are left far above the balloon. Sometimes when the balloon is descending with great rapidity and sand is thrown out—as it of course must be to lighten the balloon, and thus check the

descent—the sand is left above in the air and comes rattling down upon the balloon and upon the heads of its passengers, giving the first warning, possibly, of a deviation from a straightforward course to all save the aeronaut himself, who is argus-eyed, and on the lookout for the slightest change in altitude or direction.

And then, as to the causes which lead to the rising and falling of the balloon, independent of the will of the aeronaut. If the balloon has received considerable buoyancy at the outset, it rises until the envelope or bag holding the gas is distended to its fullest capacity through the lessened atmospheric pressure from without. The gas escapes throughout the open neck of the balloon, which serves as a sort of safety valve. Sometimes it becomes necessary, also, to relieve the gas pressure by allowing it to escape through the valve at the top. In case of a very rapid ascent, where the gas envelope is already distended to its utmost, failure to do this would probably result in the bursting of the balloon, and the instantaneous emptying of the entire gas contents, and it is thus made a very considerable part of an aeronaut's business to do the right thing at the right time. Nothing so much depends upon the coolness as well as the knowledge and skill of a single person, as in the navigation of a balloon—and by navigation, of course, is meant simply its regulation as to upward and downward courses, landing, etc., for there is no control to be had over its direction except so far as contrary currents, where they exist, may be made available. The balloon must necessarily go whither it is wafted by the wind.

The rays of the sun in heating the gas in the balloon will cause it to expand and rise, and the cooling of the balloon by the intervention of a cloud between it and the sun, will invariably cause a downward tendency. In a partially cloudy day a balloon is thus subjected to a succession of changes in its condition, which necessitate the expenditure of much gas or ballast, as the case may be, to check its rising or falling tendencies. It frequently happens, on approaching a forest or large body of water, that the balloon suddenly begins to fall, and a descent into the tree-tops or a plunge into the waves must be guarded against.

THE GUIDE ROPE.

The guide rope consists of a rope of several hundred feet in length attached to the ring of the balloon, and hanging down so that its lower end trails out on the surface of the ground, the object being to prevent the continual waste of gas and ballast that takes place in an ordinary balloon journey, as such an expenditure is otherwise always going on, owing to the necessity of keeping the balloon from getting either too high or too low. If a balloon provided with a

guide rope sinks so low that a good deal of the rope rests on the earth, it is relieved of so much weight, and if it contains enough gas to lift the weight of the apparatus, it rises again; if, on the contrary, it rises so high that but a little is supported by the earth, a greater weight is borne by the balloon, and if this weight exceeds the ascensive power in the balloon, an equilibrium is gradually produced.

THE COLLAPSING CORD.

All modern balloons of any size, if properly built, are furnished with a collapsing cord. This is a stout rope, sewed to the interior lining of the balloon from the crown down in such a manner as to enable the aeronaut, by a vigorous pull, to split the balloon from top to bottom and discharge the gas instantly.

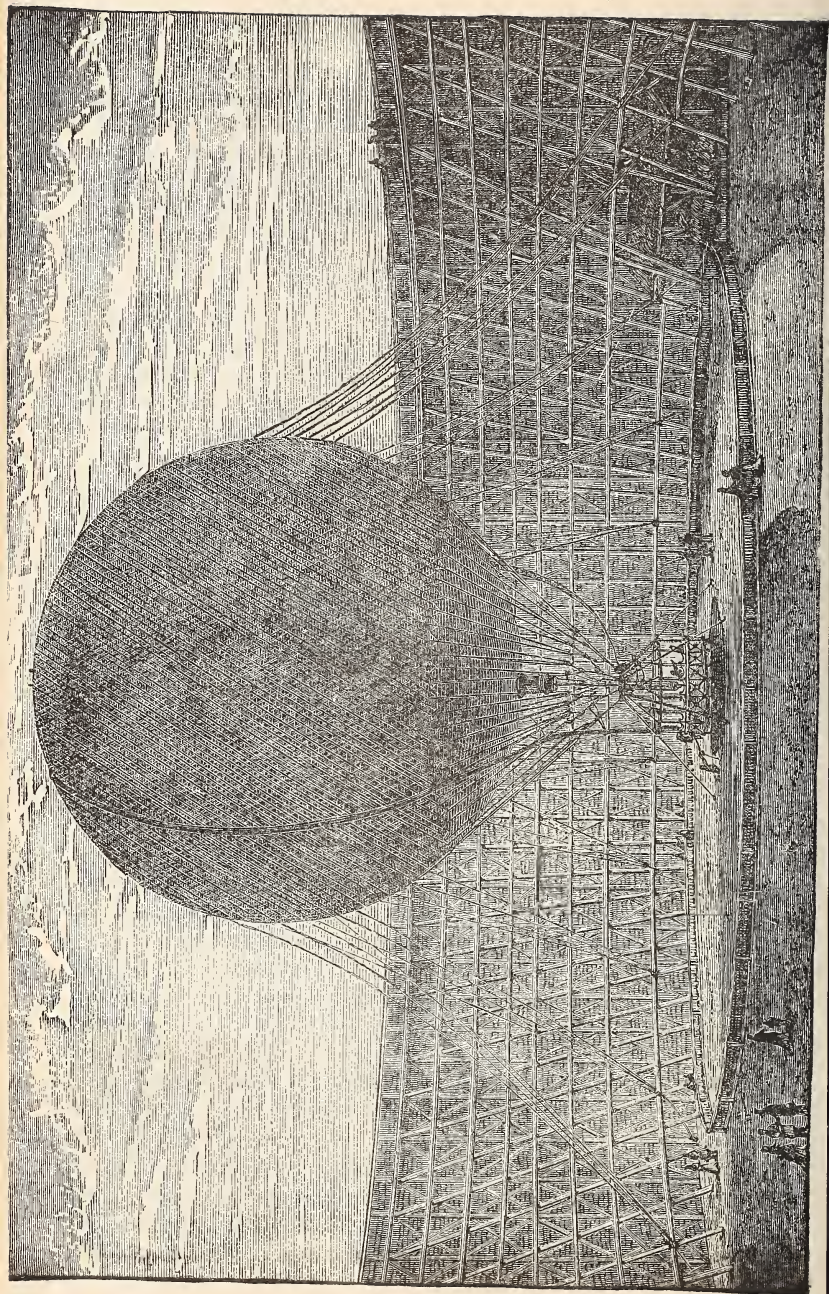
THE FRENCH CAPTIVE OF 1867.

In 1867 M. Giffard constructed a balloon of 176,500 cubic feet capacity, which was used as a captive at the time of the French International Exhibition of that year. It was inflated with hydrogen gas and made a number of ascensions, and was regarded as a success. It was exhibited in a circular inclosure, built to protect it from the weather. It was called *The Entreprenant*, and was afterwards burst while undergoing inflation, at Havre, in September, 1868, preliminary to an attempt to cross the English Channel.

THE LONDON CAPTIVE.

In 1869 M. Giffard constructed a captive balloon at Chelsea, near London, in a circular inclosure formed of linen upon a wooden frame extending to the height of a five-storied house. The diameter of the inclosure was 575 feet. In the centre of this space stood the balloon, 121 feet high. The apparatus for hoisting was similar to that used with the captive of 1878. The rope was 2,132 feet long, and weighed 5,900 pounds. Its breaking strain was 40,000 pounds. The first ascension was not made until a fortnight after the inflation. The material weighed 5,500 pounds. This balloon made a number of ascensions during very severe winds without accident. Its first ascension was May 3, 1869. Its career as a captive terminated on the 28th of the same month.

The balloon was carelessly allowed to break loose, when it shot away and was found some twenty leagues from London, near Linslow. The car was not injured in the least. This balloon was put together and sent to Paris, whence it made an ascension under the name of *The*



North Pole, on June 27, 1869. It descended at Anneau. The operations of this balloon were not successful, financially or otherwise.

GIFFARD'S CAPTIVE OF 1878.

The Captive Balloon of Paris, of 1878, was operated for three months in the Court of the Tuileries during the Exposition with great success and without a single accident.

It was one of the chief objects of interest to visitors at the Exposition. In its general plan of construction it, with its apparatus, was similar to that used by Prof. King, during the present season, except that the gas was manufactured by the wet process, while Prof. King uses steam. The history of this balloon furnishes a record of success and credit to its projector from first to last.

The ascensions were commenced by the aeronautic crew of M. Giffard. The car contained six persons, but the wind, which was violent, drove the car above the Seine, almost above the baths of Pont Royal. A bather there came near being drowned, so overcome with surprise was he to see the balloon hovering above him. This first ascension took place on Friday, the 19th of July, about six o'clock in the evening. As in former ascensions, the cable, which was not sufficiently stretched in advance, got caught upon the spires of the windlass, occasioning severe shocks, the effect of which was very singular. These afterwards ceased entirely. The wind was very strong next day, so that the second ascension did not occur until Sunday, the 21st of July. The wind was then very quiet, and the ascension almost vertical. *Le Petit Moniteur*, *le Temps*, *le National* and *le Soir* were represented in the car by one of its editors. The falling of the temperature was only one degree centigrade for 300 metres, due to the repose of the atmosphere, while the night before it had been four times that amount.

Towards the close of the week the Captive balloon for the first time ascended to the height of 500 metres.

MM. Jansens, member of the Institute and war aeronaut; Ganchon, Secretary of the Association of the War Aeronauts, Perre; Bosc, aeronaut; Admiral Mouchez, Danbree, Baron Thinar, member of the Institute; Mandron, Secretary of the Institute, unceasingly participated in these preliminary ascensions. Certain members disappeared at the moment of departure, while others sent letters of congratulation from a distance.

Before opening the Captive balloon to the public it was subjected to the examination of a committee formed by the Prefect of Police.

The committee gave their approval while advising some modifica-

tions in detail, and expressed their approbation of the general principles as well as of the construction of the apparatus.

The first public ascension of this balloon was on Sunday, July 28. The first passenger was an American, who had stood at the head of a line since morning. The number of trips made were twelve, and were prolonged without interruption till sunset. Women were there in great numbers and were not among the least enthusiastic. Among the passengers who most attracted the public attention were three members of the Japanese mission.

The next day the ascensions commenced early and were very numerous. The wind blew from the south-southwest and propelled the balloon for the first time over the Rue de Rivoli. The inhabitants of that quarter, surprised by this visit, regarded it with great attention. From this side, in heavy winds, the projection of the balloon might reach the church Saint-Roche and the car the Grands Magasins du Louvre.

A strange incident occurred one day. A balloon which had been launched from Grenelle passed so near the Captive that it was necessary to stop its upward progress to avoid a collision. This balloon, which seemed very small, carried one aeronaut and a passenger in its car.

On August 3 the habitués of the Court of the Carrousel had the opportunity of seeing the novel sight of the balloon penetrating the zone of clouds, which was owing to their low altitude. About seven o'clock in the evening the balloon was floating about 400 metres high, when one of the passengers perceived the silhouette of the balloon reflected upon a cloud as upon a mirror, and which was surrounded by iridescent colors of irregular form. By a singular optical delusion the shadow of the balloon rose in proportion as the balloon descended toward the earth.

Sunday, the 5th of August, M. Leon Say made his ascension. It occurred about one o'clock. M. Giffard occupied the car, with the Minister of Finances and the gentlemen who formed his suite. All that day two different currents, blowing simultaneously above Paris, could be plainly distinguished, which caused the presence of mist in the air.

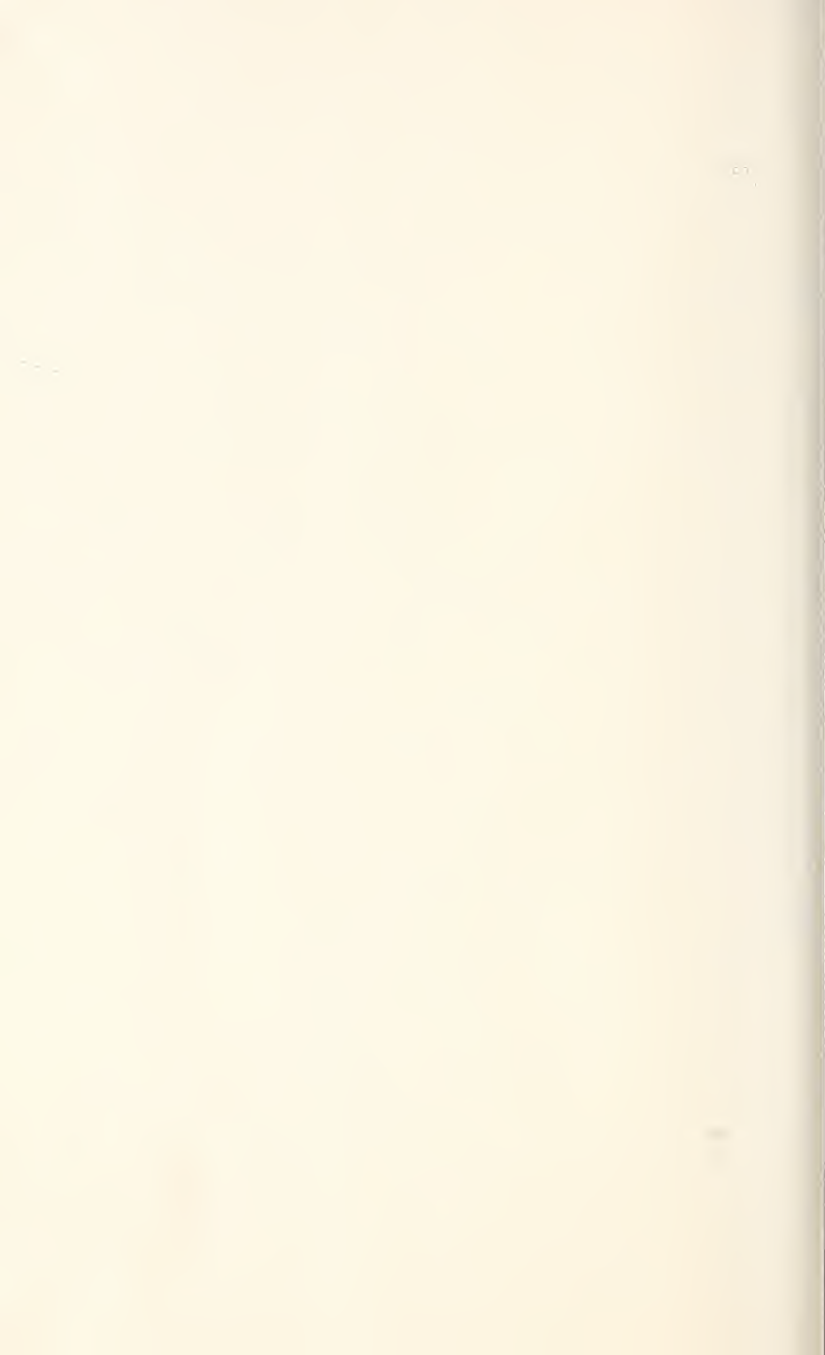
The height to which the French captive balloon ascended was nearly 2,000 feet. The panorama that lay spread out to view at this height baffled description. Below were the Tuileries; near by the Seine in its winding course, looking like a trail of blue ribbon. All the public buildings could be fairly distinguished—the great Arc de Triomphe, the Vendôme Column, the Invalides, the Place de la Concorde, the Exhibition Buildings, all focused at a single point—a grand spectacle, to witness suspended in mid-air.

It would be difficult to estimate the number of visitors to the Paris

balloon of 1878. It was very great, and among those who ascended were many very notable persons. Sara Bernhardt, the celebrated actress, was a daily passenger, and has recorded her experiences in a work lately published.

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